The Aniline Colours

of the

Badische Anilin- & Soda-Fabrik

Ludwigshafen /Rhine

and

their Application on Wool, Cotton, Silk

and other Textile Fibres.

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Moscow Works.
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**wool, cotton, silk, &c.**

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IX
Introduction.

In the following we give a full account of the application, shade, and fastness of the Aniline Colours we produce. No Aniline dye is known which is absolutely fast, and the demands of the Textile Industry vary to an enormous extent. For these reasons we cannot take upon ourselves responsibility for the statements made regarding their fastness, although they are deduced from the most careful examination. Our intention is to render it easier for those interested in them, to choose suitable products with which to make their own trials.

At all events, it is important that the dyer should know which of our colours are the fastest of their group. If these do not satisfy his requirements, then either his standard is altogether too high, or choice must be made from products of a different nature, e.g., Alizarine Colours, Indigo, &c.

On the other hand, it frequently happens that one or another of the Aniline Colours is used in large quantities for some special purpose, being fast enough for the article in question, although in some respects it is only moderately fast.

In connection with that part of the book relating to the treatment of the Aniline Colours, there are separate chapters containing detailed statements regarding the dyeing of cotton, wool, and silk, &c.; also the precautions that must be taken, and the difficulties that are encountered. From the nature of the subject this part is fully open to criticism, but in no way is it intended to offer anything new to the practical expert, or to the specialist of any distinct branch.

However, on the other hand many a young dyer who wishes to make himself as competent as possible, and indeed many a practical man with experience in one branch, who wishes to commence work with a material of another nature, will be able to profit by it.

Care has therefore been taken to avoid all unnecessary chemical explanations in the above-mentioned part, so that every one, even beginners, will be able to understand it, and so that it will not be too tedious.

Badische Anilin- & Soda-Fabrik.
Storage of Colours.

The colours should be kept in a cool dry room which is not open to the direct rays of the sun. Care must also be taken that they cannot be damaged by leakages of steam or water pipes.

Barrels or tins that have been opened should always be kept well covered up with the lids, so as to prevent the colours becoming adulterated with the dust from other dyestuffs, or from absorbing too much moisture from the air.

The above-mentioned absorption of moisture and also of carbonic acid from the air has an injurious effect on only a few colours (e.g., Acid Magenta S and the Red Violet S brands)—and even with these only when they are allowed to stand for a long time. With other products (e.g., Methyl Violet) it causes a troublesome conglomeration, rendering the dye difficult to take out and to dissolve. Others (e.g., many of the acid black dyes) may absorb moisture from the air amounting to $\frac{1}{10}$ of their weight, without the powder changing at all in appearance. It is however quite easy to see, that it must be very unpleasant for the dyer, if he does not know the exact strength of the colour he is using.

Paste colours must always be well stirred up before weighing out. If they are allowed to stand for a long time, a sediment forms and the upper layers therefore become thinner and have less colouring power, whereas in other pastes the upper layers become more concentrated by evaporation.

In the case of paste colours, it is always advisable to force a coarse cotton cloth between the uninjured lid and the rim of the barrel. After taking out colour from a barrel, any paste adhering to the side should be pushed down with a small wooden scroper, so as to give the paste a smooth surface again.

The colour should always be weighed out in the store room, or in a small room adjoining it, and it is best to have a special reliable workman told off for this purpose. The greatest possible care must be taken to prevent dust from the dyestuffs getting into the dye-house, or into the rooms where the cloth is stored or finished.
Dissolving.

Place the dye in a suitable wooden tub, pour over it a sufficient quantity of pure boiling water (distilled water is best), and stir until no more small lumps can be seen. Allow to settle for a few minutes, then pass through a fine wire or hair-sieve or through a coarse cotton cloth into the dye-bath. Any undissolved dye remaining behind on the sieve or in the dissolving vessel, must be treated in the same manner with more hot water.

The amount of water necessary for dissolving the colours varies very much. With several products one can only dissolve \( \frac{1}{2} \) lb. in 10 gallons of water, whereas as much as 5 lbs. (and in exceptional cases still more) of others can be dissolved in the same amount.

Notes.

1. As a rule bad results will be obtained if the dyestuff is added to the hot water instead of proceeding as above.

2. Care must be taken that only dyestuffs of a similar chemical nature are dissolved together. In some cases it is indeed possible to dye with basic and acid, or acid and substantive dyes together, but on the other hand, it is never permissible, as a rule, to dissolve them together.

3. In several cases the solubility is increased by:—

   a) adding a little acetic acid to the dye, or to the water used for dissolving it, (e. g., most basic dyes).

   b) adding a little soda to the dye, or to the water used for dissolving it, (e. g., Alkali Violet, several Acid Violets, and some substantive dyes, &c.).

   c) Besides the real spirit colours (Spirit Blues, Japan Blacks, &c.) which are insoluble in water, and must therefore be dissolved in Acetone, hot spirit, &c., there is also a series of basic dyes (e. g., Diamond Magenta, Magenta Scarlet, &c.) which dissolve more easily in water when a little spirit is used.
Dissolving.

The dye is stirred with about an equal weight of spirit, and boiling water is then poured slowly over it.

If the other precautions (compare 3a and 6) are taken, it is not necessary to work according to this method, which is only made use of when one wishes to work quicker and easier.

4. Some products must not be dissolved in boiling water, but in water of a temperature of about 122—140° F. (e. g., Auramines, Vesuvines, Chrysoidines).

5. In other cases, the colours can be more quickly dissolved by stirring to a thin paste with cold water, then pouring boiling water over this (e. g., Alkali Blues, Methylene Blues).

6. With certain colours it is best to use both precautions mentioned under 3a and 5 (e. g., Malachite Green, Victoria Blue, &c.).

7. With certain products, e. g., Cotton Red S, Kryogene Blacks, and other sulphur dyes, an addition of caustic soda, sodium sulphide, &c. is required in order to bring about complete solution.

In the following description of the different dyestuffs, notes are given in all cases where special precautions or additions are necessary when dissolving them.

If very carefully carried out, the practice of dissolving the colours by introducing a steam pipe into the tub and boiling up is not risky in itself. It frequently happens, however, that the dyestuff caked on to the steam pipe and is partially decomposed, or that the liquid boils over, causing a considerable loss of colour.

The method frequently adopted of dissolving the colour in hot water taken from an exhausted but acid bath, can also cause a great amount of trouble. Such water causes several products to become resinous, or (e. g., Diamond Magenta) to become difficultly soluble, on account of the formation of sulphates, or of the presence of a large amount of Glauber’s salt in the water.

A list of colours that can be dissolved in old acid dye liquors, is to be found on page 499.

If the colour is dissolved in the dye-vat itself, instead of in a vessel set apart for the purpose, there is of course always a danger of undissolved parts sticking to the sides, perforated false bottom, heating pipes, &c., which may cause a whole dyeing to be spoilt.

If one wishes to work in this manner, it is best to place the colour in a wire-sieve which is held in the hot dye-liquor. Solution and filtration are then brought about at the same time, by alternately raising and lowering the sieve in the liquid.
Dissolving.

In many dyeworks a large amount of colour solution is prepared for stock. This is certainly very convenient for the dyer, and in the case of many products there is no disadvantage connected with it. It must, however, be remembered that several dyestuffs crystallise out from their solutions on cooling (e.g., Orange N, Diamond Magenta, Victoria Blue R, &c.) and that others on long standing lose in strength (e.g., Vesuvine, Diamond Green, &c.).

Some care must therefore be taken in choosing the colours, and the best way of avoiding any damage is to prepare very dilute solutions, and to add them through a sieve to the dye-bath.
Nature and Properties

of the

Aniline Dyes.
For practical reasons, the Aniline Colours are generally divided into the following groups:

1. Acid dyes.
2. Basic dyes.
3. Dyes of the Eosine group.
4. Substantive dyes (which dye cotton or unions without a mordant).
   Sulphur dyes, i.e., dyes containing sulphur.
5. Mordant dyes.
6. Developed dyes.
7. Dyes insoluble in water or Spirit Colours.

1. Acid Dyes.

These colours are chiefly used for dyeing wool, but they are also applied to silk, and with few exceptions the dyeing takes place in an acid bath. They are of only little interest for cotton, but on the other hand they are of great importance for jute.

To this group belong:—


The various Blue Blacks, Brilliant Blacks, Palatine Blacks, Palatine Chrome Blacks, also the soluble Deep Blacks. Methan Blacks 3BN and E. Burl Black.

To this group also belong: —

The Alkali Violets and Neutral Blue for Wool. (These colours are dyed in a neutral bath, i.e., without any acid).

The Alkali Blues. (These are dyed in an alkaline bath.)

Mordant Yellow G, GR, R. Fast Mordant Yellow G. Palatine Chrome Brown A, W. Palatine Chrome Red R. Palatine Chrome Violet. Anthracene Blue WGG. Anthracene Blue SWGG extra. On account of their properties these products are generally dyed on unmordanted wool and after-chromed, or they may be dyed on mordanted goods. They can also be dyed in the ordinary way in an acid bath, but the dyeings obtained in this manner are of little importance.

2. Basic Dyes.

In the textile industry these colours are chiefly used for mordanted cotton. Large quantities are also consumed in silk dyeing, and a considerable amount of a few brands is used for wool. They are also extensively used for jute dyeing.

To this group belong: —


Also the Victoria- and Night Blues (with the exception of Victoria Blue R, however, they are dyed on wool in a strongly acidified bath).

Rhodamine B, G, 3B, 5G, 6G, and S (for wool only Rhodamine B and G are used, and these are consumed in large quantities. They are dyed in a slightly acidified bath).
3. Dyes of the Eosine group.

In the textile industry these colours are used for wool and silk, also to a small extent for cotton.

To this group belong: —

The soluble Eosine, Erythrosine, Phloxine, and Rose Bengal brands. Uranine.

Iris Blue can also be classed in this group.

4. Substantive Dyes (which dye unmordanted cotton).

These are very largely consumed for dyeing cotton and unions; they are also used for wool and silk.

To this group belong: —


With this group also rank: —

Union Blacks B, BB, 4 B, which as indicated by their name are only intended for unions and offer no advantage for cotton. Also Kryogene Brown, G. Kryogene Blue G, R. Kryogene Olive. Anthraquinone Black. Fast Black B, BS. The Kryogene Black brands. All of these are used for cotton and require to be dyed by a special process.

5. Mordant Dyes.

Amongst our Aniline Colours we have only one that belongs to this group, that is, if one considers a mordant dye to be one which absolutely requires a metal salt for the production of the colour (or colour lake).
This product is our Dark Green paste, which is used for cotton and silk, and to a limited extent also for wool.

(Of course, in a general sense, all products are mordant dyes which require to be dyed on previously mordanted material, and which require the mordant to fix them, e.g., the basic colours.)

6. Developed Dyes.

For information regarding the various kinds of developed colours, see page 184.

a) Substantive dyes that can be diazotised and developed on the fibre are, Sulphine, Oxamine Violet, Oxamine Blue RRR, B.G. Oxamine Black N, A.

b) The following substantive dyes can be changed into a new product when on the fibre, by means of a diazotised developer:—Pyramine Orange 3G, Oxamine Red, Oxamine Maroon, Oxamine Blue BG, Cotton Black B, BN, and C. Cotton Yellow G and GI also belong to this class.

c) Dyes which are produced on the fibre in an insoluble condition from substances possessing in themselves either no dyeing properties at all, or else such of quite another nature to the colour actually produced,

1. by means of a chemical reaction: Nitrosamine Red,
2. by means of an oxidation process: Aniline Black.

The developed colours are chiefly used for dyeing cotton; several of them are also used for silk and unions.

7. Dyes insoluble in water or Spirit Colours.

These are used for dyeing silk, and when dissolved in acetine for printing silk and cotton, also for making coloured varnishes, &c.

To this group belong:—

Quinoline Yellow soluble in spirit, Cerolavine, Eosine soluble in spirit, Coralline. All Spirit Blues. Parme soluble in spirit. All Indulines and Nigrosines soluble in spirit. All Japan Blacks. Deep Black N.

Acetine Blue also belongs to this group.

In the sequel we give a detailed description of the dyeing properties, fastness, and method of application of the more important colours of the above groups.
Acid Dyes.

**Quinoline Yellow.**

*Quinoline Yellow*  
*Quinoline Yellow extra.*

**Quinoline Yellow** is the purest and greenest acid yellow that is to be found on the market at the present time. It is used in all cases where a very clear shade that is fast to light is required.

It is used for wool and silk dyeing, also for printing wool. It is indispensable to the latter branch, as it can be used in the discharge pastes themselves.

When used for shading green and blue (Light Green or Victoria Blue) also for pinks (Rhodamine) it gives the most brilliant shades that can be produced.

**Quinoline Yellow extra** is twice as strong.

It is used for the same purposes as the ordinary brand.

Other uses:—The Quinoline Yellows are also used to a certain extent for dyeing cotton.

**Dyeing process** for wool: No. 1, page 94  
» » » silk: No. 1b, page 247 (also No. 4, page 249)  
» » » cotton: No. 6, page 162.

**Tartrazine.**

*Tartrazine*  
*Tartrazine H.*

The shade of **Tartrazine** is the nearest to that of Flavine. It is extremely fast to light, being faster in this respect than the above-mentioned vegetable dye, and it replaces it on this account.

It serves both for dyeing and printing wool.

It is highly valued as it dyes comparatively level, and also because it is not decomposed by boiling. The fastness to washing of Tartrazine is above the average.

Other uses:—It is used to a small extent for dyeing silk. Tartrazine is also the most suitable yellow for producing shot effects on materials consisting of wool and silk, as under the ordinary conditions of dyeing it leaves the silk unstained.

Dyeing process for wool: No. 1, page 94

Dyeing process for silk: No. 1b, page 247 (or No. 4, page 249).

Naphthol Yellow.

Naphthol Yellow S | Naphthol Yellow SII
Naphthol Yellow SE | Naphthol Yellow SO.

Naphthol Yellow S was discovered and placed on the market by us in 1877. It is very largely used, especially for dyeing wool, on account of its beauty, strength, and cheapness, and because it dyes very level. Picric acid has been almost entirely replaced by it.

It can easily be dyed in combination with other acid colours. The other Acid Yellows are, however, faster to light.

The brands SE and SII only differ from S in strength. SO is weaker and redder than S.

Other uses:—In addition to wool dyeing Naphthol Yellow is also used for dyeing silk, for printing wool, &c.

Dyeing process for wool: No. 1, page 94

Dyeing process for silk: No. 1a, page 247 (or No. 4, page 249).

Fast Yellow.

Fast Yellow | Fast Yellow G
Fast Yellow Y | Fast Yellow extra.

The Fast Yellows occupy a very important place in wool dyeing. They dye with such extreme evenness that they can be used for the most delicate fancy shades. They are also very fast to light. Fast Yellow G is the greenest, whilst Y is the reddest and strongest.
Acid Dyes.

When working with Fast Yellows, it must be borne in mind that acids turn the shade redder, and for this reason the goods must be well rinsed.

Other uses:—In addition to wool dyeing, the Fast Yellows are also used for printing woollen yarn and piece-goods.

Dyeing process for wool: No. 1, page 94.

Azoflavine.

The chief brands for wool are Azoflavine RS and FF. For silk all brands are used, but more especially the greenish Azoflavine S, and the extra greenish Azoflavine 3G extra.

The brand FF which is very similar in shade to Azoflavine RS, is specially adapted for silk dyeing, as it does not contain anything that is soluble in fat.

For this reason silk that has been dyed with it will not give a yellow fatty stain on tissue-paper.

Originally the Azoflavines were only used for producing full fast shades on silk, the greener brands being also fast to acids. They have, however, gradually obtained a place in wool dyeing on account of their property of dyeing very even shades.

As they dye wool quite readily in a neutral bath, they are also used for dyeing unions by the one-bath method.

The Azoflavines are fast to alkalies and light.

They are similar in shade to, but more expensive than, Metanil Yellow and Orange N, but have the advantage of not being so sensitive to acids.

The very reddish Azoflavine II differs in properties from the other brands. It is easily soluble and gives clear solutions, and is used for many special purposes.

Other uses of the Azoflavines:—They also serve for dyeing cotton, jute, straw, cocoa-nut fibre, and China grass. Azoflavine FF is specially adapted for wool printing.

Method of dissolving: Use a large quantity of hot water. (The solution always remains slightly dull. All additions when dissolving are useless. Azoflavine FF gives a clear solution.)

Dyeing process for wool: No. 1, page 94

<table>
<thead>
<tr>
<th>Azoflavine S</th>
<th>Azoflavine SGR extra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azoflavine RS</td>
<td>Azoflavine SGR extra</td>
</tr>
<tr>
<td>Azoflavine RR</td>
<td>Azoflavine 3G extra</td>
</tr>
<tr>
<td>Azoflavine RRR</td>
<td>Azoflavine II</td>
</tr>
<tr>
<td>Azoflavine FF</td>
<td></td>
</tr>
</tbody>
</table>

[The table continues with more entries for different azoflavine brands.]

» » » silk: No. 1b, page 247 (also No. 2, No. 3, or No. 4)
» » » cotton: No. 6, page 162.

**Metanil Yellow** and similar dyes.

*Metanil Yellow*

*Metanil Yellow extra.*

**Orange N**

**Orange PN**

**Brilliant Yellow S.**

On account of their strength and cheapness, Metanil Yellow and Orange are used in very large quantities for producing full fancy shades on wool. They possess the advantage of being very full overhand, and of being fast to alkalies and comparatively fast to light.

**Metanil Yellow** and **Metanil Yellow extra**, which is three times as strong, are greener than **Orange N**. They have the advantage over the latter of being more soluble, and of dyeing more evenly, so that they can be used for light fancy shades.

Both of these products have the peculiarity of becoming redder in a bath that is strongly acid, so that a dyer who is not acquainted with them, can only judge of the shade after the dyeings have been rinsed.

**Brilliant Yellow S** does not dye so evenly as Metanil Yellow, but it is fast to acids and considerably faster to milling and light.

Other uses:— *Metanil Yellow, Orange N, and PN* are extensively used for dyeing silk. They are also suitable for dyeing unions, as they dye well in a neutral bath. **Brilliant Yellow S** is very fast to water, and is therefore suitable for printing wool.

Method of dissolving **Orange N** and **PN**: Use a large quantity of hot water. (All additions when dissolving are useless.)

Dyeing process for wool: No. 1, page 94

Dyeing process for silk: No. 1a, page 247 (or No. 4, page 249).

**Mordant Yellow.**

*Mordant Yellow G*

*Mordant Yellow GR*

*Mordant Yellow R*

*Fast Mordant Yellow G.*

The fastness and shade of the various dyes of this group are only fully developed when dyed on chrome-mordanted wool, or when the dyeings that have been produced in an acid bath are after-chromed.
Acid Dyes.

They are of minor importance for dyeing in an acid bath.

Other uses:—Fast Mordant Yellow G can also be used for dyeing silk.

Dyeing process for wool: No. 1, page 94. (For working on a chrome mordant, see process No. 5, page 104.)
Dyeing process for silk: No. 4, page 249.

Palatine Chrome Brown.

Palatine Chrome Brown W
Palatine Chrome Brown A.

These products differ from one another only in point of strength, they dye wool in an acid bath, but the shades so produced are not very full or very fast. If, however, as soon as the bath is exhausted, the wool is after-chromed in the usual manner, full brown shades that are very fast to light are obtained. The Palatine Chrome Browns are used in this manner as self-colours, but more often in conjunction with other dyes that also require to be after-chromed. They can also be used for light shades, as they give very level dyeings.


Orange.

Orange G
Orange II
Orange II P
Orange R
Orange RS
Orange GR

Orange GRX
Orange X.

Silk Red N
Silk Red G.

The cheapest of the acid orange dyes having regard to colouring power, is Orange II.

It is also the most extensively used. Most medium and dark fancy shades on wool can be produced with it, as it dyes evenly enough for this purpose. The yellower Orange G is about the same in this respect, but it is more expensive and not so strong.

Orange R and X are redder in shade than the above, they are also faster to milling than most of the acid orange dyes. They do not give quite such level shades as Orange II and G.
Orange GR is used more extensively for dyeing cotton, &c. than for the animal fibres, as it is essentially better adapted for this purpose than the ordinary orange brands.

The Oranges are fast to light, the best in this respect being Orange G and GR.

In addition to being used for wool, the brands Orange II, 11P, X, and R are also used for producing shades on cotton that do not require to be fast to washing.

They are all used for dyeing silk.

Other uses:—For printing wool, for dyeing jute, cocoa-nut fibre, &c., Orange X is specially adapted for the latter purpose.

Dyeing process for wool: No. 1, page 94

Dyeing process for silk: No. 1b, page 247 (or No. 4)

Dyeing process for cotton: No. 6, page 162 (specially for Orange GR and X).

Silk Red N. As indicated by its name it is specially used for dyeing silk. It is highly prized for this purpose on account of its full shade and comparative fastness to water.

On wool, the shades produced with it are faster to milling than those of the other acid reddish Oranges.

Method of dissolving: Use a large quantity of hot water, as it is rather difficult to dissolve.

Dyeing process for silk: No. 1b, page 247 (or No. 4)

Dyeing process for wool: No. 1, page 94.

Silk Red G. It is very similar in properties and shade to Silk Red N. Although it has not the same colouring power as the latter, it is considerably cheaper.

Dyeing process for silk: No. 1b, page 247 (or No. 4).

Acid Rhodamine.

Patent Acid Rhodamine R
Patent Acid Rhodamine RR
Patent Acid Rhodamine RRR.

The yellowest of these products is the brand R, (it is similar in shade to the Eosines) whereas RRR possesses a very blue shade. (It is similar but not so bright as Rhodamine B.) Acid Rhodamine RR comes half-way between these two.
They are all used for dyeing wool in an acid bath and also for silk. They are valued for dyeing silk and cotton unions when two-colour effects are wanted as they leave the cotton quite white. The most important is Acid Rhodamine \( R \), both on account of its shade and its comparative fastness to light.

**Dyeing process for wool:** No. 1, page 94    
» » » silk: No. 1b, page 247. 

### Scarlet

| Scarlet G | Scarlet RRR |
| Scarlet R | Scarlet RRR superfine |
| Scarlet RR | Scarlet RRRF |
| Scarlet 2 RF | Scarlet 6 R. |

The brands G—RRR are extensively used for producing scarlet shades on wool, especially on flannel. They resist the action of light very well, and are also fast enough against bleeding into white in the flannel milling. They stand stoving, and as self-colours they dye level shades.

On the other hand they are hardly suitable for use in obtaining fancy shades.

The most extensively used is the brand *Scarlet RR*.

For wool dyeing the bluish brand *RRR* can be replaced by *Scarlet RRRF*, which possesses the same shade and is cheaper. For the same reasons the brand *2 RF* can take the place of *Scarlet RR*.

**Scarlet 6 R** is used for bluish shades. It does not give such level shades as the other brands and is not fast to stoving.

Other uses:—They also serve for dyeing silk and for printing slubbing.

**Dyeing process for wool:** No. 1, page 94    
» » » silk: No. 1b, page 247 (or No. 4). 

### Wool Scarlet and similar dyes.

| Wool Scarlet G | Wool Scarlet RRRR. |
| Wool Scarlet R | Cochineal Red A |
| Wool Scarlet RR | Crystal Scarlet. |

The colours of this group give still brighter shades on wool than the Scarlets, and on account of their low price, they are largely used as substitutes for them. They are a trace faster to light than the Scarlets. With the exception of
Wool Scarlet G, they are not fast to stoving, and this prevents them from being used for quite a number of purposes. They are also more liable to bleed in the flannel milling than the Scarlets.

The chief brand is Wool Scarlet RR.

The bluest and strongest of the Wool Scarlet dyes, is Cochineal Red A.

Dyeing process for wool: No. 1, page 94.

Crystal Scarlet. This brand is highly prized for many purposes on account of its fine blue shade. It is also used for wool printing.

Dyeing process for wool: No. 1, page 94.

Palatine Scarlet.

Palatine Scarlet A
Palatine Scarlet RRR
Palatine Scarlet RRRR.

These products resemble the Scarlets and WoolScarlets in general properties. They are faster to stoving and also a trace faster to light than the latter.

They give beautiful bluish red shades which cannot be produced in any other way. For this reason they are very extensively used as substitutes for cochineal. They are faster to light than the latter, and also considerably cheaper, and in addition to this their application is much simpler and more reliable.

The chief brand is Palatine Scarlet A, which is frequently brightened with a little Rhodamine.

The Palatine Scarlets are used in all branches of wool dyeing (yarn, piece-goods, plush, hats, fez), for printing woollen yarn and pieces, and also for dyeing silk.

Dyeing process for wool: No. 1, page 94
Dyeing process for silk: No. 1b, page 247 (or No. 4).
**Cotton Scarlet** and similar dyes.

<table>
<thead>
<tr>
<th>Cotton Scarlet</th>
<th>Erythrine RR</th>
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<tbody>
<tr>
<td>Cotton Scarlet extra</td>
<td>Erythrine X</td>
</tr>
</tbody>
</table>
|                   | Erythrine P.

**Cotton Scarlet** and **Cotton Scarlet extra** are both of the same shade, they only differ in strength.

**Erythrine RR** is somewhat bluer and more delicate in shade.

These products are only used to a limited extent for wool. They are slightly faster to washing than the Scarlets and Wool Scarlets, which are similar in shade but cheaper.

As they give bright scarlet shades which are fast to air, they are still used for dyeing cotton goods that do not require to be fast to washing. They have, however, been replaced to a great extent by the substantive dyes.

The colours of this group are also very important for dyeing jute, linen, and cocoa-nut fibre, especially the brands **Erythrine X** and **P**.

Dyeing process for wool: No. 1, page 94

Dyeing process for silk: No. 1b, page 247 (or No. 4)

Dyeing process for cotton: No. 6, page 162.

**Fast Scarlet.**

*Fast Scarlet G*

*Fast Scarlet GGN*

*Fast Scarlet B.*

The chief brand is **Fast Scarlet B.** It gives fuller scarlet shades on wool than the ordinary Scarlets.

It is faster to milling and washing than the latter, or than any other dyes of a similar shade, and is also fast to light.

Only small quantities of the Fast Scarlets are used for cotton, but they are important for dyeing jute and cocoa-nut fibre.

They are also used for silk dyeing, and are more suitable for this purpose than any other acid scarlets.
As they dye wool in a neutral bath, they are also used for dyeing union goods by the one-bath process.

**Fast Scarlet GGN** is the best red of our assortment for dyeing wool and silk the same shade, in materials composed of these two fibres.

Dyeing process for wool: No. 1, page 94

> > > silk: No. 1b, page 247 (or No. 4).

**Sorbine Red.**

These products are distinguished by giving perfectly level dyeings, so that they can be used even for the most delicate fancy shades. **Sorbine Red BB** is bluer than the ordinary brand, and specially adapted for drab and grey shades.

They are fast to light and sufficiently fast to acids, and are they used in all branches of wool dyeing.

These colours are also used for wool printing, especially for carpet yarn, as they penetrate the goods well.

The Sorbine Reds are also used for dyeing silk.

Dyeing process for wool: No. 1, page 94

> > > silk: No. 1b, page 247 (or No. 4).

**Fast Red** and similar dyes.

<table>
<thead>
<tr>
<th>Fast Red AV</th>
<th>Naphthol Red G, S</th>
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<tbody>
<tr>
<td>Fast Red B</td>
<td>Mars Red G</td>
</tr>
<tr>
<td>Fast Red C</td>
<td>Silk Red R.</td>
</tr>
<tr>
<td>Fast Red E.</td>
<td></td>
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</tbody>
</table>

The dyes of the Fast Red group are extensively used in all branches of wool dyeing, for producing deep red and claret shades. They also serve for producing browns, navy blues, &c.

**Fast Red** was first manufactured by us, and has found a very extensive application on account of its strength and low price.

If a certain amount of care is taken when working with it, no difficulty will be found in obtaining level shades.

The commercial brand is called **Fast Red AV**.
**Fast Red E** is very similar in shade to the brand *AV*, but it has not the same covering power. On the other hand it is very soluble and is not taken up so rapidly by the wool, and in consequence produces more level dyeings. It is therefore often used in preference to the latter brand. Large quantities of it are consumed for dyeing woollen plush, fez, &c. The brand *Fast Red E* has recently been largely replaced by the cheaper *Naphthol Red G* which is very similar in shade and also gives more level dyeings.

**Fast Red C** is bluer than the above. It does not dye quite so evenly as the brand *E*, but is faster to light than the other Fast Reds. It is also fast to stoving.

**Mars Red G.** This colour, which we have had on the market for some time past, is an improved *Fast Red C*. In general properties it is the same as the above, but it is not so strong. It is brighter and bluer in shade than the old brand, and also gives more level shades. It can therefore be used for several—not too delicate—fancy shades.

**Silk Red R.** This product is very similar in character to Silk Red G, but is very much bluer in shade. Both colours possess the important advantage of being comparatively fast to water when dyed on silk.

   **Method of dissolving:** Use a large quantity of hot water as the colour is difficult to dissolve.

   **Dyeing process for silk:** No. 1b, page 247 (or No. 4).

**Naphthol Red G.** As already mentioned this product is very similar in shade to *Fast Red E* and can replace it with advantage.

**Naphthol Red S.** This colour is very extensively used on account of its bright blue shade, low price, and its property of dyeing level shades. In the latter respect it is about equal to *Mars Red G*.

   It is used for the same purposes as *Fast Red AV* and *E*.

**Fast Red B** is the bluest in shade of the whole group. It does not produce specially level dyeings, but is faster to milling than the average. This brand is also comparatively fast to light.
Other uses:—The various Fast Reds are used for printing wool. Large quantities are also consumed for silk dyeing, especially of the brands Fast Red AV and C. The brand Fast Red AV also serves for jute dyeing. As it dyes wool full shades in a neutral bath, it is likewise used for dyeing union goods by the one-bath method.

Method of dissolving for Fast Red AV and B: Use a large quantity of hot water, as the products are rather difficult to dissolve.

Dyeing process for the whole group:—
for wool: No. 1, page 94
silk: No. 1b, page 247 (or No. 4). For Fast Red AV also No. 2 and No. 3.

Palatine Chrome Red R. (Patent applied for.)

This dye resembles Fast Red AV in shade but is slightly duller. It is exclusively used for producing fast dyeings by the so-called one-bath process, adding bichromate of potash to the bath after dyeing, and it can be used in combination with all the products suited for use in this process.

Palatine Chrome Red possesses a comparatively good fastness to light, it is fast to milling and sufficiently fast in the potting process. In consequence of these properties, it can be used for goods that require to be faster than those dyed with the ordinary red Aniline dyes.


Azocarmine.

The chief brand Azocarmine G is placed on the market in the form of a paste, whereas the somewhat bluer brands Azocarmine B, BB, BX are delivered as powders.

All these products were first produced by us, and they are acknowledged to rank with the very best colours for dyeing level shades.

No fancy shades exist, however delicate, which cannot be dyed perfectly evenly with these colours. They have replaced Archil to a very great extent in wool dyeing.
Acid Dyes.

These colours are fast to light, acids, and street dirt.

The Azocarminé brands also serve for dyeing silk, and when used for materials consisting of wool and silk, both fibres are dyed the same shade. Azocarminé is a valuable colour for wool printing, especially as it can be used in the discharge pastes.

Method of dissolving: Azocarminé G, paste, is somewhat difficult to dissolve, but can be used without danger even when it is only partially dissolved.

Dyeing process for wool: No. 1, page 94
» » » silk: No. 1b, page 247 (or No. 4).

New Claret L.

This product dyes full and extremely bright claret shades on wool in a neutral bath. For this reason it is specially adapted for dyeing union goods. Pure wool or shoddy can be dyed with it in a neutral or an acid bath. It is also very suitable for dyeing silk.

Dyeing process for wool: No. 2, page 99 or — for working in an acid bath— No. 1, page 90.
Dyeing process for silk: No. 1a, page 247 (or No. 4).

Acid Magenta S and similar dyes.

Acid Magenta S | Acid Maroon S
Acid Magenta SN | Red Violet 5 RS
Acid Magenta SS | Red Violet 4 RS
Acid Magenta ST | Red Violet 4 RSN.
Acid Magenta SIII.

Acid Magenta S, the first member of this group, was discovered and first placed on the market by us. This, and all the other brands which were brought out later, are distinguished by their brilliant shade, and especially by the very full bloom of dyeings on wool. For these reasons the Acid Magentas are indispensable for many purposes. On the other hand, they are not fast to street dirt and perspiration. In many cases, therefore, they have on this account been partially or entirely replaced by other products which are faster in this respect, such as Acid Violet 4 R, the red azo-dyes, &c.

The most important yellowish brand is Acid Magenta S
» » » bluish » Red Violet 4 R S.
Acid Maroon \( S \) is only used for inferior materials.

Other uses:—The Acid Magenta- and Red Violet \( S \) brands are also employed for dyeing silk, straw, and feathers. (In the latter branch they are chiefly used for blacks.) They are also very suitable for producing shot effects on materials composed of wool and silk, as the silk is only dyed to a very slight extent.

Dyeing process for wool: No. 1, page 94

» » » silk: No. 1b, page 247 (also No. 4).

**Palatine Chrome Violet.**

This product belongs to the group of so-called chrome colours, that is to say, it can be dyed on wool in an acid bath and subsequently be treated with bichromate in the same bath. In this way brown-violet shades are obtained which possess a comparatively good fastness against light, washing, and milling.

Palatine Chrome Violet is but seldom used as a self-colour, on the other hand, it is highly valued for use together with other chrome colours for the production of shades of claret, brown, and dark marine blue.


**Acid Violet.**

<table>
<thead>
<tr>
<th>Acid Violet 3BN</th>
<th>Patent Acid Violet 6BN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid Violet 4BN</td>
<td>Acid Violet 7B</td>
</tr>
<tr>
<td>Acid Violet 4BS</td>
<td>Acid Violet 4R</td>
</tr>
<tr>
<td>Acid Violet 4BL</td>
<td>Acid Violet BB</td>
</tr>
</tbody>
</table>

These are very important dyestuffs for wool, especially the brands 6BN, 3BN, 4BS, and 4BL.

They are very extensively used on account of their good dyeing properties, their strength, and cheapness.

These colours dye fairly level shades, especially the brands 6BN and 3BN, and are sufficiently fast to street dirt for practical purposes. They are also moderately fast to light.

In combination with Brilliant Black, (and to a certain extent with wood colours) they serve for producing full dark blues. With Wool Green S, Wool Blue S, &c., they give bright navy blue shades.
Acid Violet 7B is somewhat brighter than 6BN, but does not dye so evenly and is not so fast to rubbing.

It is used in large quantities in conjunction with logwood.

Acid Violet 4R is the reddest member of this group. It does not give such level shades as the brands 6BN, 5BN, 4BN, and 3BN, but is essentially faster than these to washing, alkalis, and especially to light.

Acid Violet BB is one of the oldest brands and for most purposes has been replaced by our other products. This colour penetrates comparatively well and produces fairly level shades.

Other uses:—The brands Acid Violet 3BN, 6BN, and BB are used for printing wool. All of them find application for dyeing silk, feathers, and hats; and for straw the brands Acid Violet BB, 4R, and 7B are used.

Acid Violet 4BN, 6BN, and also Acid Violet 5BN, which stands in shade between the last two, are specially adapted for brightening the wool of union goods that are dyed by the one-bath method.

Method of dissolving: The brands 4BN, 6BN, and 7B are difficult to dissolve. In case of difficulty attend to note 3b, page 3. (Under no circumstances should acids be added when dissolving.)

Dyeing process for wool: No. 1, page 94

Dyeing process for silk: No. 1b, page 247 (also No. 4). For Acid Violet 3BN and 4BN also No. 2 or No. 3.

Dyeing process for Acid Violet 4BN on wool: No. 1, page 94. (Attend to note 1d, page 91.)

Alkali Violet.

Alkali Violet 6B
Alkali Violet 4B
Alkali Violet R.

As indicated by the letters, the brand 6B is the bluest of the Alkali Violets. R is the reddest, whilst 4B comes between these two.

At the present time Alkali Violet 6B is the most important brand, and its properties represent those of the whole group. These colours play a very important part in wool dyeing, on account of their bright shade, their strength, and fastness to milling.
They also possess the valuable property of dyeing wool in a neutral bath, and for this reason they are extensively used for dyeing shoddy and union goods, and also for brightening the wood colours.

Alkali Violets can only be used to a limited extent in combination with acid colours, as they require to be dyed in a neutral bath. Good results can, however, be easily obtained, by first boiling the goods for half an hour in a neutral bath, and then adding the bisulphate or acid. In this time the Alkali Violets will be almost completely taken up by the wool.

Method of dissolving: Use a large quantity of hot water, also attend to note 3b, page 3. (Under no circumstances should acids be added when dissolving.)


Dyeing process for silk: No. 1 b, page 247 (also No. 2, No. 3, or No. 4).

Patent Neutral Blue for Wool.

This colour possesses the same property as Alkali Violet of dyeing wool in a neutral bath. For this reason it is very valuable for producing navy blue shades on unions, being used in conjunction with substantive dyes for this purpose. It is also of great importance for dyeing shoddy.

This product is not quite as fast to milling as the Alkali Violets, but it is comparatively fast to light.


Wool Blue. Wool Marine Blue.

<table>
<thead>
<tr>
<th>Wool Blue S</th>
<th>Wool Blue S N L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wool Blue SL</td>
<td>Wool Blue R</td>
</tr>
<tr>
<td>Wool Blue SN</td>
<td>Wool Marine Blue BN</td>
</tr>
</tbody>
</table>

The Wool Blues are very similar in shade to the Indigo Carmines. They were placed by us on the market as cheap substitutes for the above when dyeing dark shades. Wool Blue S especially, is very extensively used for producing dark navy blues, Russian greens, &c., as it dyes quite evenly enough for this purpose. It is also sufficiently fast to street dirt and rubbing for practical purposes.
Wool Blue SN has the same properties as Wool Blue S. It is, however, duller in shade, but also somewhat cheaper.

Other uses of Wool Blue:—As a cheap blue for the hat industry (ladies' hats), also for printing wool and dyeing silk.

Method of dissolving: Wool Blue S and SN should be dissolved in a large quantity of hot water. Attention should be paid to note 3b, page 3. (Under no circumstances should acids be added when dissolving.)

Dyeing process for wool: No. 1b, page 247.

The newer brands Wool Blue SL and SNL are used for the same purposes as the above.

They have the advantage over Wool Blue SN, of not "bronzing" even when carelessly dyed in an acid bath.

Wool Blue R is considerably redder than the other brands, and is also faster to alkalies. There is no danger of it becoming bronzy when working in an acid bath.

Dyeing process for Wool Blue SL, SNL, and R: No. 1, page 94.

Wool Marine Blue BN gives navy blue shades when used as a self-colour.

In fastness and dyeing properties, it is the same as Wool Blue SL.

Indigotine.

As previously mentioned, these colours have been replaced to a great extent by cheaper substitutes. It will however be very difficult to replace them for producing very delicate fancy shades, as they give perfectly level dyeings under all conditions. They can therefore be added to the boiling bath without any danger. These colours are comparatively fast to light, and do not change their shade in artificial light.

The Indigotine brands are delivered as powders, but the Indigo Carmines and Indigo Extracts as pastes.

Other uses:—The above products are extensively used for shading other colours and for hat dyeing (gentlemen's and ladies' hats and fez). They are also made use of for washing blue, &c.

These are the most suitable blues for producing shot effects on materials composed of wool and silk, as under the ordinary conditions of working they leave the silk almost colourless.

Dyeing process for wool: No. 1, page 94.

**Light Green (Acid Green)** and similar dyes.

| Light Green SF yellow shade | Bluish Green S |
| Light Green SF blue shade | Neptune Green S |
| Light Green S | Neptune Green SB |
| Acid Green GB |

The first colours of the Acid Green group were placed on the market by us. They are used under the names Light Green SF, S, Acid Green GB, &c., for producing a series of blue, green, and fancy shades, which must be as cheap as possible and do not require to be specially fast, especially to alkalies (street dirt).

**Bluish Green S**, which was issued later on, is very much better in the latter respect. It is bluer in shade than the above, and is quite fast enough for most practical purposes. This colour has also the advantage of being fast to water (fast to water milling).

On account of the above properties, *Bluish Green S* can be used for many purposes for which Light Green is not fast enough, and the finer blue or green even-dyeing colours are too expensive.

**Neptune Green S** is bluer in shade than *Bluish Green S*. They both give equally level shades, but the former is not quite so fast to alkalies.

**Neptune Green SB** is the newest brand of this group. It gives much bluer and clearer shades than *Neptune Green S*, and for this reason it is an important colour for dyeing wool and silk as a self-colour. Its other properties are similar to those of *Neptune Green S*. 

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""
Other uses:—These colours, besides being used for dyeing wool, also serve for printing wool, and in addition to this large quantities are used for dyeing silk and feathers.

Bluish Green S is fairly suitable for dyeing straw, and Light Green S for jute.

Dyeing process for wool: No. 1, page 94
> > silk: No. 1b, page 247 (or No. 4).

**Wool Green S.**

This product was first placed on the market by us, and, without doubt, takes highest rank with the most even-dyeing colours. It is fast to light, street dirt, &c., and is very extensively used as a substitute for the ordinary Acid Greens on the one hand, and the Indigo Extracts on the other.

Like most other colours which give very level shades, the bath does not become completely exhausted. For this reason, too much acid should not be used when dyeing, in order to utilise the colour as well as possible.

**Wool Green S** leaves the cotton decorative threads in woollen piece-goods sufficiently clear.

Other uses:—**Wool Green S** is used in all branches of wool-, union-, and hat dyeing, &c. It is also a valuable colour for silk, feathers, straw, and jute.

Dyeing process for wool: No. 1, page 94
> > silk: No. 1a, page 247 (also No. 2 or No. 4).

**Soluble Blue.**

<table>
<thead>
<tr>
<th>Soluble Blue RRRR</th>
<th>Soluble Blue I extra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soluble Blue RR</td>
<td>Soluble Blue O</td>
</tr>
<tr>
<td>Soluble Blue TR</td>
<td>Methyl Soluble Blue, night blue</td>
</tr>
<tr>
<td>Soluble Blue TB</td>
<td>Red Blue R</td>
</tr>
<tr>
<td>Soluble Blue LS</td>
<td>Pure Blue I</td>
</tr>
<tr>
<td>Soluble Blue IV red shade</td>
<td>Pure Blue II</td>
</tr>
<tr>
<td>Soluble Blue IV green shade</td>
<td>Pure Blue WA</td>
</tr>
<tr>
<td>Soluble Blue IV medium shade</td>
<td>Silk Blue B</td>
</tr>
<tr>
<td>Soluble Blue PP</td>
<td>Soluble Blue 3376</td>
</tr>
<tr>
<td>Soluble Blue III</td>
<td>Soluble Blue HA</td>
</tr>
<tr>
<td>Soluble Blue II</td>
<td>Soluble Blue HB</td>
</tr>
<tr>
<td>Soluble Blue IN</td>
<td>Soluble Blue SV</td>
</tr>
<tr>
<td>Soluble Blue IB</td>
<td></td>
</tr>
</tbody>
</table>

The most important of the finer brands of this group for dyeing wool, are **Soluble Blue TB and TR, Pure Blue I and II, Soluble Blue IN.**
Of the cheaper brands, the most important are:—Soluble Blue 3376, HA, HB, SV, IV red shade, IV green shade, and IV medium shade.

The above brands are also used for silk dyeing, also Silk Blue B and the much greener and purer Methyl Soluble Blue. In many cases, however, the latter can be replaced by Soluble Blue IN, which although not so clear is much cheaper.

For cotton, the brands Soluble Blue IV red shade, IN, and Pure Blue I are specially suitable; further the very fine brands Soluble Blue IB, I extra, O, and Methyl Soluble Blue.

The Soluble Blues are not suitable for producing fancy shades on wool. On the other hand, they are extensively used on account of their bright blue shades, for brightening dyeings produced with logwood. In the latter case they are generally added to the chrome liquor, although it is much more rational and reliable to add them to the logwood liquor itself, and then to brighten by adding a little acetic acid.

The members of this group are also highly prized for dyeing in one bath with logwood, copper sulphate, ferrous sulphate, and oxalic acid.

Their bright shades are absolutely fast to acids; they are also very strong colouring matters and are comparatively fast to light. In both these respects they are superior to the Acid Violets, which are also used for the above purposes. They are, however, not nearly so fast to rubbing as the latter.

The Soluble Blues are very rapidly absorbed by wool, and in consequence they are very liable to rub off. To a certain extent this can be counteracted by careful dyeing (adding the acid slowly) and by rinsing well on the machine. This difficulty cannot, however, be entirely overcome when dyeing pure wool. When dyeing union goods by the several-bath method, this drawback is almost entirely removed by the after-treatment with sumach and iron in the rinsing machine.

The Soluble Blues are valuable for cotton dyeing, as they give bright shades that are comparatively fast to light, and they are dyed in a very simple manner.

Other uses:—The Soluble Blues are also used for dyeing jute, linen, and cocoa-nut fibre, and for printing materials composed of cotton and silk.

Dyeing process for wool: No. 1, page 94 (also No. 6, page 106, or No. 8, page 108)
> » » silk: No. 2, page 248 (or No. 3)
> » » mordanted cotton: No. 1, page 165
> » » unmordanted cotton: No. 4, page 159.
Alkali Blues.

<table>
<thead>
<tr>
<th>Alkali Blue 5R</th>
<th>Alkali Blue BB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkali Blue 4R</td>
<td>Alkali Blue BBB</td>
</tr>
<tr>
<td>Alkali Blue RR</td>
<td>Alkali Blue 5B</td>
</tr>
<tr>
<td>Alkali Blue RR</td>
<td>Alkali Blue 6B</td>
</tr>
<tr>
<td>Alkali Blue R</td>
<td>Methyl Alkali Blue, night blue</td>
</tr>
<tr>
<td>Alkali Blue B extra</td>
<td>Alkali Blue 40</td>
</tr>
<tr>
<td>Alkali Blue B</td>
<td>Alkali Blue 4BD</td>
</tr>
</tbody>
</table>

The Alkali Blues are very similar in composition to the Soluble Blues. They differ from the latter, however, in having very little affinity for cotton, and of dyeing wool in a neutral bath (see process No. 3, page 101).

When the Alkali Blues are dyed according to this method, the combination of the colour with the fibre takes place slowly. It is therefore quite easy to obtain perfectly level dyeings. Light shades that have been produced with these colours are fairly fast to rubbing.

On the average, the Alkali Blues are a little faster to light than the Soluble Blues. They can also be considered faster to washing, as the shade of the goods that have been washed is restored to a greater extent if some acetic acid is added to the rinsing water, than is the case with the Soluble Blues.

The comparatively cheapest brands of the Alkali Blue group are Alkali Blue BB, B extra, and 40. In many cases they can be used in place of the finer, greener, but much more expensive Alkali Blue 6B and Methyl Alkali Blue.

Alkali Blue 4BD is much easier to dissolve than the above brands, and is therefore preferred for printing purposes.

Other uses:—They are used in preference to the Soluble Blues for dyeing silk, at least if the latter has to be weighted with sumach.

Method of dissolving: Use a large quantity of hot water. If necessary attend to note 3b, page 3. (Attention is also drawn to note 5, page 4).

Dyeing process for wool: No. 3, page 101
Dyeing process for silk: No. 2, page 248 (or No. 3).

Methan Dark Blue R.

This product is specially adopted for producing full navy blue shades on men's clothing materials, chiefly those produced from shoddy. The dyeings obtained with this colour are very full overhand; they are also fast to acids and sufficiently fast to rubbing.

Dyeing process for wool: No. 1, page 94.

Fast Blue. Wool Printing Blue.

<table>
<thead>
<tr>
<th>Fast Blue K</th>
<th>Fast Blue 5B.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast Blue R</td>
<td>Induline NN</td>
</tr>
<tr>
<td>Fast Blue RR</td>
<td>Wool Printing Blue</td>
</tr>
<tr>
<td>Fast Blue greenish</td>
<td>Patent Printing Blue for Wool.</td>
</tr>
<tr>
<td>Fast Blue extra greenish</td>
<td></td>
</tr>
<tr>
<td>Fast Blue B</td>
<td></td>
</tr>
</tbody>
</table>

These dyestuffs possess similar properties to the Soluble Blues, and to a great extent they are used for the same purposes.

They are not suitable for producing fancy shades.

If dyed in combination with logwood, copper sulphate, and ferrous sulphate, they give dark blues which are fast to acids and wearing.

They are also extensively used for dyeing cheap colours on shoddy.

When used in combination with Brilliant Black, very dark blue shades are obtained which are comparatively fast to light, but are not quite fast to rubbing.

The brand *Fast Blue K* is used as a self-colour for dyeing cheap dark blues on piece-goods. For this purpose, however, it has recently been replaced to a great extent by Methan Dark Blue R.

In order to render dyeings that have been produced with Fast Blue, as fast to rubbing as possible, they must be well washed with fuller's earth.

Induline NN. On account of its clear shade and other good properties, this colour is extensively used for dyeing and printing silk. It is also used for many purposes in wool dyeing.

Other uses:—The Fast Blues are also useful for silk dyeing. They also serve for producing grey and bluish grey shades on cotton when sizing.

Method of dissolving: Use a large quantity of hot water. We do not recommend any addition.

Dyeing process for wool: No. 1, page 94 (also No. 8, page 108)

» » » silk: No. 1b, page 247 (for Fast Blue 5B, process 1a is better)

» » » cotton: No. 1, page 165. (For dyeing in the size No. 8, page 229.)

Wool Printing Blue and Printing Blue for Wool. As indicated by their names they are used for printing wool; they are not suitable for dyeing.
Acid Dyes.

**Nigrosine.**

<table>
<thead>
<tr>
<th>Nigrosine W soluble in water</th>
<th>Nigrosine WG soluble in water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigrosine WL soluble in water</td>
<td>Nigrosine DW soluble in water</td>
</tr>
<tr>
<td>Nigrosine WH soluble in water</td>
<td></td>
</tr>
</tbody>
</table>

In properties and method of application, the soluble Nigrosine and Induline brands resemble the Fast Blues. They are, however, greyer and not so bright as the latter.

**Nigrosine WL** is not so sensitive to alkalies as the other members of this group.

Other uses:—These colours are used for silk dyeing and also for dyeing cotton in the size.

For the latter purpose they are used for producing light shades, in the same manner as the Fast Blues.

**Method of dissolving:** same as the Fast Blues.

**Dyeing process for wool:** No. 1, page 94

**Dyeing process for cotton:** No. 1, page 165. (For dyeing in the size No. 8, page 229.)

**Dyeing process for silk:** No. 1b, page 247.

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**Brilliant Black. Palatine Black. Methan Black.**

<table>
<thead>
<tr>
<th>Brilliant Black BBB</th>
<th>Patent Palatine Black B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brilliant Black B</td>
<td>Patent Palatine Black 4B</td>
</tr>
<tr>
<td>Brilliant Black E</td>
<td>Patent Palatine Black 5BN</td>
</tr>
<tr>
<td>Brilliant Black M</td>
<td>Patent Palatine Black 5BA</td>
</tr>
<tr>
<td>Brilliant Black BD</td>
<td>Patent Palatine Black 6BE</td>
</tr>
<tr>
<td>Blue Black B</td>
<td>Patent Palatine Black 6B</td>
</tr>
<tr>
<td>Deep Black E</td>
<td>Methan Black 3BN</td>
</tr>
<tr>
<td>Deep Black R</td>
<td>Methan Black E</td>
</tr>
</tbody>
</table>

The dyes of the Brilliant Black group are very important, especially the brands **B** and **E**. They have reduced the amount of wood colours consumed to a very great extent, the reason being that it is so very easy to work with them, they are extremely fast to light, and at the same time fast to acids and comparatively cheap.

**Brilliant Black E** and **M** yield a deep black self-colour. The **M** brand is very economical in use.
The redder brand **Brilliant Black B** is used as a self-colour, or better still shaded with yellow (Metanil Yellow, Tartrazine, Azoflavine, Naphthol Yellow) for dyeing deep black shades on piece-goods. For this purpose from $3-8\%$ of dyestuff is required, the exact amount depending on the quality of the wool. As a rule woollen yarn requires more colour. These products are not suitable for loose wool, as the tips remain too light.

**Brilliant Black BBB** is bluer in shade than $B$ or $E$. It is generally used in combination with Acid Violet for producing dark navy blues, the brand *Acid Violet 6BN* being the most suitable for this purpose.

For hard worsted or cheviot piece-goods, an average of about $2\frac{1}{4}-3\frac{1}{2}\%$ Brilliant Black BBB and $0.6\%$ Acid Violet 6BN is required.

If care is taken that the colour is sufficiently exhausted, the Brilliant Black brands leave the cotton decorative threads in woollen piece-goods unstained. The best method is to add a little more bisulphate to the bath after the colour is almost completely exhausted, and to boil for another $\frac{1}{4}$ hour.

**Blue Black B** is stronger, but more expensive to work with than Brilliant Black.

It has, however, the advantage of being faster to washing and alkalis than the latter. Stiffened hats, for example, that have been dyed with it, will resist rinsing with a soda solution to a sufficient extent.

**Deep Black E** and **R** are similar in properties to **Blue Black B**, but they give fuller shades and have more covering power.

**Brilliant Black BD** is especially adapted for printing wool.

Other uses:—**Brilliant Blacks B, E, and M** have recently come into use for dyeing hair hats. When used in combination with green and yellow they give excellent results.

Brilliant Black is also suitable for dyeing materials consisting of silk and wool. If correctly dyed the wool is black, and the silk remains much lighter than the wool. An after-treatment with acetate of ammonia (page 277) will then strip the silk to such an extent that good shot effects can be produced on the goods.

Dyeing process for wool: No. 1, page 94.
The Palatine Blacks are the most recently introduced members of our black group.

**Palatine Black 4B** is used for the same purposes as the Brilliant Blacks. It is also used in place of them when any burls present in the goods require to be darkened a little, and when very deep shades are required. If when dyeing piece-goods with this colour, the cotton decorative threads should remain white, the same precautions must be observed as when working with Brilliant Black, i.e., a fairly large quantity of bisulphate (e.g., 10—15%o) is added after the bath is almost exhausted, and the boiling is then continued for some time.

**Palatine Black 6B** and **6BE** only differ from one another in strength. They are used for shading towards blue on wool. As they dye wool in a neutral bath, they are also suitable for union goods, being good and cheap substitutes for other more expensive colours.

The brand **Palatine Black 4B** also is adapted for dyeing really black shades on union goods.

**Palatine Black 5BN** is somewhat bluer overhand than 4B.

**Palatine Black 5BA** is somewhat purer and greener in shade than 4B.

**Palatine Black B** dyes full deep black shades which come in cheaper than those produced with 4B.

The Palatine Blacks are not quite so fast to light, neither do they penetrate so well or dye so evenly as the Brilliant Blacks. On the other hand they suffice for most practical purposes, and they are also very cheap.

Other uses:—**Palatine Black 4B** and 6B are used for dyeing silk, as they give very full shades. They are especially adapted for dyeing both fibres of materials consisting of wool and silk the same shade. These colours are also very extensively used for hat dyeing.

**Dyeing process for wool:** No. 1, page 94

**Dyeing process for silk:** No. 1b, page 247 (also No. 4).

**Methan Black 3BN.** This colour is specially intended for dyeing blue-black shades on ladies' clothing material in a quick and easy manner. It is very similar to logwood in depth of shade and bloom, and for this reason it has become generally appreciated.

**Methan Black E** corresponds to the brand 3BN in dyeing properties and fastness, but gives a deeper black.

**Dyeing process for wool:** No. 1, page 94.
Palatine Chrome Black.

Palatine Chrome Black A
Palatine Chrome Black 3B.

These colours form a group for themselves, as in order to produce the correct black shades and the extreme fastness which is peculiar to them, they require to be after-chromed.

Palatine Chrome Black A is chiefly intended for deep blacks. Mordant Yellow R or GR are the most suitable colours for shading or deepening this black.

Palatine Chrome Black 3B has the great advantage of being bluer overhand than the brand A. It is, however, not so full underhand.

Both colours are especially adapted for piece-goods, but they are also suitable for most kinds of woollen yarn. They are of less importance for dyeing slubbing and loose wool, as good results (with regard to dyeing the tips, &c.) cannot be obtained on every quality of this class of wool. They are moderately fast to milling, and if after-chromed correctly, they are extremely fast to light.

Palatine Chrome Black can be used in combination with other blacks without being after-chromed, in case a bright reddish black is required which only needs to be moderately fast to light.

Other uses:—The Palatine Chrome Blacks are now extensively used for dyeing wool and hair-felt hats. They are specially adapted for this purpose, as they are extremely fast to light and also fast to steaming.


Burl Black. See page 71.

Anthracene Blue.

Anthracene Blue WGG paste
Anthracene Blue SWGG powder.

These products only differ from each other in form and strength, one being placed on the market in the form of a paste, and the other as a powder. Considering their nature, they really belong to the Alizarine Colours, but they can also be dyed in an acid bath along with the ordinary acid colours.
Acid Dyes.

They do not give specially level shades, but still with a little care satisfactory results can be obtained. Care should, however, be taken that the dyeings do not require shading off and that no other colours are used for this purpose (e.g., Indigo Carmine, Wool Green S).

These dyes are fast to light, being better in this respect than Indigotine, Wool Green S, &c. They also possess the important advantage of not changing their shade in artificial light, which makes them very suitable for drab and brown shades. In addition to this they are fast to alkalis, &c.

Other uses:—On account of their fastness to light these products are used for producing light grey shades on straw and chip.


**Anthracene Blue SWGG extra.** This new brand is brighter in shade and gives somewhat more level dyeings than *Anthracene Blue WGG* or *SWGG*. The notes given above regarding the methods of working with these brands also hold good for *Anthracene Blue SWGG extra*. 
Basic Dyes.

**Auramine.**

|-------------------|-------------------|

**Auramine G** is the greenest member of this group. The remaining brands \(O, OE, I, II, IIE\) have all the same shade, and only differ from each other in strength.

The chief brand is *Auramine II*.

These colours are only used in small quantities for wool, but on the other hand they are consumed in very large quantities for cotton dyeing.

On tannin-mordanted cotton, they give very full shades which are comparatively fast to washing and light. For these reasons they are highly valued as the yellow constituent of olives, greens, browns, and scarlets.

It must, however, be borne in mind that these colours should not be dissolved or dyed at the boil, but at a temperature of \(120-140^\circ F\).

Other uses:—In addition to cotton dyeing, Auramine also serves for calico printing, and for dyeing silk, jute, and cocoa-nut fibres.

**Method of dissolving:** Attend to note 4, page 4. The solutions should not be kept too long.

**Dyeing process for cotton:** No. 1 (a and b), page 165 and following pages

**Dyeing process for wool:** No. 2, page 99

**Dyeing process for silk:** No. 2, page 248 (or No. 4).

**Rheonine.**

<table>
<thead>
<tr>
<th>Patent Rheonine A</th>
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</thead>
<tbody>
<tr>
<td>Patent Rheonine N</td>
</tr>
</tbody>
</table>

The products which are placed on the market under the name *Rheonine*, were discovered by and patented to us in 1895.
The chief brand Rheonine A has a reddish shade, whereas N is greener and somewhat clearer.

Originally they were only intended for leather, and the largest quantities are consumed for this purpose. At the present time, however, owing to their fastness, they are extensively used for cotton dyeing and more especially for calico printing.

They can be used without hesitation, for producing fast colours in place of the more expensive Phosphines and Cannelles.

Method of dissolving: In case of difficulty use distilled water. If this cannot be obtained attend to note 3a, page 3.

Dyeing process for cotton: No. 1 (a and b), page 165 and following pages
> > > silk: No. 2, page 248 (or No. 4).

Cannelle. Phosphine.

Cannelle
Cannelle OF
Phosphine N.

As these colours are very expensive they are only used to a small extent for cotton and linen. For instance they are used for dyeing cream shades on lace and curtains, also for producing parti-coloured effects on plush which is composed of several fibres (cotton, silk, China grass, wool, linen) and which is dyed in the piece.

These colours are very important for dyeing leather, but as already mentioned they have been replaced to a large extent by Rheonine.

Method of dissolving: In case of difficulty use distilled water. If this cannot be obtained attend to note 3a, page 3.

Dyeing process for cotton: No. 1 (a and b), page 165 and following pages
> > > silk: No. 2, page 248 (or No. 4).

Flavinduline.

Patent Flavinduline O
Patent Flavinduline II.

These colours are comparatively fast to washing, and for this reason they are used for special purposes in cotton dyeing, and more especially for printing cotton yarn and calico.

Flavinduline O has the same shade, but is stronger than Flavinduline II.

Dyeing process for cotton: No. 1 (a and b), page 165 and following pages.
Chrysoidine. Vesuvine.

<table>
<thead>
<tr>
<th>Chrysoidine A</th>
<th>Vesuvine extra (Bismarck Brown)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrysoidine R</td>
<td>Vesuvine R (Bismarck Brown)</td>
</tr>
<tr>
<td>Chrysoidine RL</td>
<td>Vesuvine S (Bismarck Brown)</td>
</tr>
<tr>
<td>Chrysoidine T crystals</td>
<td>Vesuvine O (Bismarck Brown)</td>
</tr>
<tr>
<td>Chrysoidine E crystals</td>
<td>Vesuvine OO (Bismarck Brown)</td>
</tr>
<tr>
<td>Vesuvine BB (Bismarck Brown)</td>
<td>Vesuvine OOO extra (Bismarck Brown)</td>
</tr>
<tr>
<td>Vesuvine B (Bismarck Brown)</td>
<td>Vesuvine OW (Bismarck Brown).</td>
</tr>
</tbody>
</table>

These bright orange yellow to dark brown colours are used for dyeing and printing cotton, both as self-colours and also as mixtures for producing cheap dark fancy shades. In addition to this they serve for topping substantive dyes or cutch.

At the present time the cheapest brands are *Chrysoidine RL, Vesuvine BL, Vesuvine extra.*

Only very small quantities of these products are used for silk. On the other hand they serve for dyeing jute.

**Method of dissolving:** In case of difficulty use distilled water. If such cannot be obtained, attend to note 3a, page 3. Note 4, page 4, should not be overlooked.

**Dyeing process for cotton:** No. 1, page 165 and following pages

**» » » silk:** No. 2, page 248 (or No. 4).

**Saffranine** and similar dyes.

<table>
<thead>
<tr>
<th>Saffranine T extra</th>
<th>Saffranine S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saffranine XX</td>
<td>Saffranine Scarlet G</td>
</tr>
<tr>
<td>Saffranine TK</td>
<td>Saffranine Scarlet B.</td>
</tr>
<tr>
<td>Saffranine PP</td>
<td></td>
</tr>
<tr>
<td>Saffranine MN</td>
<td></td>
</tr>
</tbody>
</table>

With regard to fastness to washing and light, the Saffranines rank amongst the fastest of the basic colours.

They are quite unsuitable for dyeing wool, but on the other hand they are very extensively used, as self-colours and also in mixtures, for dyeing cotton.
The chief brand is the very concentrated *Saffranine T extra*.

The other yellow brands:—*Saffranine XX, TK, and PP* only differ from the above in strength. (Saffranine XX is, however, a little bluer in shade.)

The members of this group are of very little use for silk dyeing, but large quantities are consumed in dyeing piece-goods consisting of cotton and silk. Large amounts of this material have recently been dyed by first grounding with substantive colours and then topping with Saffranine. For this purpose the brand *Saffranine MN* is specially adapted, as it gives full shades on cotton which has been previously grounded, without rendering the silk too dark.

The bluest brand is *Saffranine S*, which possesses quite a violet shade. It can, however, be replaced for most purposes by the clearer and cheaper *Saffranine MN*, which is a little yellower in shade.

The yellowish *Saffranine Scarlets G* and *B* are used for the same purposes as the Saffranines.

Other uses:—The Saffranines also serve for printing cotton and for dyeing jute, cocoa-nut fibre, &c.

**Method of dissolving:** When working with Saffranine Scarlet B and G attend to note 4, page 4.

**Dyeing process for cotton:** No. 1 (a and b), page 165 and following pages

**Dyeing process for silk:** No. 3, page 248 (or No. 4).

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**Induline Scarlet.**

*Patent Induline Scarlet.*

*Induline Scarlet* is more extensively used for printing cotton yarn and cloth than for dyeing cotton.

The prints so obtained are fast to washing and comparatively fast to light, and this colour can be regarded as a special dyestuff for this branch.

**Method of dissolving:** Use a sufficient quantity of hot water.

**Dyeing process for cotton:** No 1 (a and b), page 165 and following pages.
Magenta. Cerise.

Diamond Magenta double refined  
Diamond Magenta needles E  
Diamond Magenta I large crystals  
Diamond Magenta needle crystals A  
Diamond Magenta I small crystals  
Diamond Magenta I small needles  
Magenta II large crystals  
Magenta II small crystals  
Magenta V1 crystals  
Magenta V2 crystals

Magenta V3 crystals  
Magenta T  
Magenta Powder A  
Magenta Powder AB  
Rubine N  
Cerise DIV  
Cerise DN  
Cerise DII  
Magenta Scarlet G  
Magenta Scarlet B.

The Diamond Magenta brands differ very little from each other in shade. On the other hand, however, there are sometimes great differences in the form and size of the crystals.

Magentas V1 — V3 are weaker than Diamond Magenta.

The most important brands for dyeing are:—Diamond Magenta I small needles, and Magenta Powder A which is more soluble and therefore easier to apply than the above.

Diamond Magenta I small crystals possesses a pure yellow shade, whilst the former brands are bluish in shade.

Diamond Magenta II small crystals is still yellower but not so clear in shade. Magenta Scarlets B and G are extra-yellow brands.

The Cerise brands are very similar to the Magentas, of which they are bye-products; they are also used for the same purposes. They differ in yielding more brownish red shades and are fuller.

Rubine N stands in shade between Cerise and Magenta.

The purer brands of Magenta are used for woollen goods, especially for flannel and knitting yarn. In the latter case the wool dyed with this colour is often mixed with white.

The Cerise brands are very seldom used for this purpose. On the other hand large quantities are consumed for cotton dyeing, as they serve both as self-colours, and also in combination with other basic dyes for producing fancy shades.
In addition to this they are extensively used for topping cutch, wood colours, or a ground of substantive dyes.

The chief brand is Cerise DIV.

Other uses:— Besides being used for cotton and wool dyeing, large quantities of the Magenta and Cerise brands are consumed for calico printing, also for dyeing silk, jute, linen, and cocoa-nut fibre.

Method of dissolving: In case of difficulty use distilled water. If this cannot be obtained, attend to notes 3a and 3c, page 3.

Dyeing process for cotton No. 1, page 165 and following pages
» » » wool: No. 2, page 99
» » » silk: No. 1a, page 247 (also No. 3 or No. 4).

Rhodamine.

<table>
<thead>
<tr>
<th>Patent Rhodamine 3B</th>
<th>Rhodamine 5G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patent Rhodamine 3B extra</td>
<td>Rhodamine 5G extra</td>
</tr>
<tr>
<td>Rhodamine B</td>
<td>Patent Rhodamine S</td>
</tr>
<tr>
<td>Rhodamine B extra</td>
<td>Patent Rhodamine S extra</td>
</tr>
<tr>
<td>Rhodamine G</td>
<td>Patent Rhodamine 6G</td>
</tr>
<tr>
<td>Rhodamine G extra</td>
<td>Patent Rhodamine 6G extra</td>
</tr>
</tbody>
</table>

The colours of this group were discovered by us in 1887, and caused a great sensation on account of their peculiar beauty.

Our brands B, G, 5G, S, and 6G extra are five times as strong as the corresponding ordinary brands. (Rhodamine 3B extra is four times as strong as Rhodamine 3B.)

For cotton, wool, and silk the most important is Rhodamine B; the brand G is a trace yellower than this, whereas Rhodamine 3B is considerably bluer. The latter is seldom used for wool or cotton.

Rhodamine 6G is the chief brand for dyeing mordanted cotton and for calico printing. It possesses a full yellowish shade and is fast to washing.

Rhodamine 5G can be used when a bluer shade is desired. These two brands are not so suitable for wool.
Rhodamine S serves for dyeing pink shades on unmordanted cotton; it is seldom used for mordanted cotton, and never for wool.

The Rhodamines are most extensively used in all branches of the textile industry that use Aniline Colours at all, both on account of their brightness and of their fastness to light which is far superior to that of the members of the Eosine group.

They are not very often used in combination with other colours, as it is the peculiar shade of Rhodamine as self-colour which is so highly valued.

On wool Rhodamine B is sometimes used along with Palatine Scarlet, Orange II, Tartrazine; or for yellower shades with Quinoline Yellow.

The best colour for shading Rhodamines towards blue is Rose Bengal NT.

On cotton, Rhodamine 6G is extensively used in combination with a little Auramine. If the amount of the latter colour be increased, the most brilliant scarlet shades that it is possible to produce are obtained, but of course they are expensive.

Rhodamine S is consumed in large quantities for brightening pinks produced with substantive dyes on unmordanted cotton. Such shades can be dyed in one bath, if substantive dyes are chosen which will withstand an addition of acetic acid to a bath which contains Glauber's salt. Thiazine Red G and R are especially adapted for this purpose.

Rhodamine B and G (and to a less extent 6G and 3B) give splendid pinks on cotton that has been mordanted with Turkey-red oil. Such yarn produces a very brightening effect if woven into parti-coloured goods along with yarn dyed with duller colours.

On the other hand, Rhodamine 6G is chiefly used for cotton that has been mordanted with tannic acid. As previously mentioned, it is very fast to washing in comparison with other dyes of the same nature.

Other uses:—The Rhodamines have found application in almost every branch of dyeing. In addition to being used for cotton, silk, and wool, they also serve for dyeing jute, China grass, &c., and for printing cotton, wool, and silk.

Dyeing process for wool: No. 1, page 94 (also No. 4, page 103)
» cotton: No. 1 (a and b), page 165 (also No. 7, page 180)
» silk: No. 2, page 248 (also No. 1a or 4)
» Rhodamine S on cotton: No. 7, page 164 (also No. 1 (a and b), page 158, and No. 4, page 177).
Methyl Violet and similar dyes.

<table>
<thead>
<tr>
<th>Methyl Violet RRRR</th>
<th>Methyl Violet BBBB extra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyl Violet RRRR extra</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet RRR extra</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet RR extra</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet RR extra</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet R extra</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet R extra</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet MB</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet MB extra</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet 170P</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet 170P extra</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet B</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet B extra</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet BB</td>
<td>Methyl Violet BBBB extra</td>
</tr>
<tr>
<td>Methyl Violet BB extra</td>
<td>Methyl Violet BBBB extra</td>
</tr>
</tbody>
</table>

The brands RRRR—BBBBBB possess the same strength as the Methyl Violets that are in general use.

The extra brands are 1/5 stronger than these.

The most important brand is Methyl Violet BB.

The reddest brand is Methyl Violet RRRR.

The bluest brand is Methyl Violet BBBB.

Dark Blue B and R, also New Blue S, when used as self-colours, give navy blue shades.

The various members of this group are used as self-colours for dyeing wool, especially for knitting yarn, bright export cloths, and similar materials. They are very important colours for dyeing shoddy, and are extensively used for this purpose in combination with Diamond Green, for producing cheap navy blue shades on dark coloured rags.

The largest quantities, however, are used for dyeing tannin-mordanted cotton, but recently they have been replaced to a great extent by Indoinie Blue, especially for navy blues, as the latter product is much faster.

Other uses:—The Methyl Violets also serve for printing cotton and wool, and for dyeing silk, jute, linen, &c.

Method of dissolving: In case of difficulty use distilled water. If this cannot be obtained, attend to notes 3a and 3c, page 3.

Dyeing process for cotton: No. 1 (a and b), page 165 and following pages
  » wool: No. 2, page 99
  » silk: No. 1a, page 247 (or No. 4).
Iris Violet. This product is used for a few special purposes, e. g., production of two-colour effects on silk, &c.

Dyeing process for silk: No. 1a, page 247 (also No. 4).

Red Violet 5R extra chiefly serves for dyeing silk. For this purpose it is better adapted than those brands of a similar shade which are mixtures of Violet and Magenta, and is used in preference to them.

Dyeing process for silk: No. 1a, page 247 (also No. 4).

Crystal Violet. Ethyl Purple 6B.

Crystal Violet possesses the same shade and properties as Methyl Violet BBBBBBB and BBBBBBB extra.

It is, however, considerably stronger than these.

Ethyl Purple 6B is the purest and bluest violet that is to be found on the market at the present time. It is, however, expensive and is therefore only used in cases where the above properties are of value.

Method of dissolving: Same as Methyl Violets.

Dyeing process for cotton: No. 1 (a and b), page 165 and following pages

» » » wool: No. 2, page 99
» » » silk: No. 1a, page 247 (also No. 4).

Cotton Blue.

Cotton Blue BB | Cotton Blue BR
Cotton Blue B | Cotton Blue R.

These products are not suitable for wool, and are scarcely used at all for silk.

On the other hand they give navy blue shades on tannin-mordanted cotton that are faster to light, &c. than those produced with Methyl Violet and Green, Dark Blue, New Blue, &c.

For some years past, however, Cotton Blue has been replaced by our Indoine Blue, which is a much better dyestuff.

Method of dissolving: Dissolve in a large quantity of hot water. If necessary attend to note 3a, page 3.

Dyeing process for cotton: No. 1 (a and b), page 165 and following pages.
Indoine Blue.

<table>
<thead>
<tr>
<th>Patent Indoine Blue BB, paste</th>
<th>Patent Indoine Blue BBN, powder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patent Indoine Blue BB, powder</td>
<td>Patent Indoine Blue BR, powder</td>
</tr>
</tbody>
</table>

These colours were discovered by and patented to us.

On tannin-mordanted cotton they give shades which are very similar to vat blues.

For many purposes they are also fast enough to replace vat blues, and for these reasons they are now very extensively used for cotton dyeing.

Indoine Blue BB possesses the greenest shade of this group.

Indoine Blue BBN dyes a similar shade, but is duller and fuller.

Indoine Blue BR is the reddest overhand.

With regard to strength, 1 part of the powder brands corresponds to 8 parts of the paste brands.

They are very fast to light, washing, and against bleeding into white.

When dyed on a sumac-antimony mordant, according to the process which has been worked out by us, and which is now very extensively used on the large scale, extremely fast blue shades are obtained which possess the closest resemblance to indigo. (See appendix page 482 and following pages.)

In cases where the dyeings do not require to be very fast, Indoine Blue can be dyed without a mordant, or on a light ground of substantive dyes, (Phenamine Blue is the most suitable for this purpose.) Such shades are, however, by no means so fast as those which have been produced on a mordant, still they are better than such as can be obtained for example with most substantive dyes.

As previously mentioned, Methyl Violet, Dark Blue, and Cotton Blue have been replaced to a great extent by Indoine Blue.

The price of Indoine Blue being very low at the present time, is a still further inducement to change.

Other uses:—Indoine Blue is of very little importance for wool, but it is used for printing wool and dyeing unions.

It also serves for calico printing, and for dyeing silk, linen, jute, and cocoa-nut fibre.
Indoine Blue RN extra is a special brand for discharge printing as it gives the purest red discharge. (See Table 18.)

Method of dissolving: Use a large quantity of hot water. We do not recommend any addition.

Dyeing process for cotton:
  a) for mordanted cotton: No. 1 (a and b), page 165 and following pages (also special process in appendix page 482 and following pages).
  b) for unmordanted cotton: No. 3, page 158.

Dyeing process for silk: No. 1a, page 247 (or No. 4).

Victoria Blue. Night Blue.

<table>
<thead>
<tr>
<th>Victoria Blue B</th>
<th>Victoria Blue BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria Blue R</td>
<td>Night Blue.</td>
</tr>
<tr>
<td>Victoria Blue 4R</td>
<td></td>
</tr>
</tbody>
</table>

The most important member of this group is the very bright and greenish Victoria Blue B.

Victoria Blue R is very similar in shade to the above, but is somewhat redder and clearer. On wool, however, it must be dyed in a neutral or slightly acidified bath, whereas the remaining brands are dyed in baths which have been strongly acidified. This brand is therefore used in such cases where this method of dyeing is advantageous, e. g., for loose wool and shoddy.

Night Blue is distinguished by its very clear shade. It is, however, very expensive, and is therefore only used for very light shades on wool (ball dresses, &c.) and for dyeing silk.

Victoria Blue B — and for redder shades also 4R — have replaced the Alkali Blues to a very great extent, as it is very easy to work with them, and they are strong dyes giving very beautiful shades on wool and possessing good fastness to stoving, milling, and washing. The Alkali Blues are now only used where better fastness to light and rubbing is desired, as they are somewhat better in this respect than the Victoria Blues.

Other uses:—Victoria Blue serves for dyeing cotton with or without a tannin mordant, also for producing bright blue shades on union felt and union flannel.

It is likewise used for dyeing jute and cocoa-nut fibre. This colour is also employed in calico printing, being fixed with a tannic acid or chrome mordant.

The brand Victoria Blue BS is somewhat stronger than B.

Method of dissolving: Use distilled water. If such cannot be obtained, attend to notes 3a and 6 on pages 3 and 4.

Dyeing process for cotton: No. 1 (a and b), page 165. Also No. 3, page 158.

- wool: No. 1, page 94. Note appendix page 98.
- silk: No. 1b, page 247 (or No. 4).
Methylene Blue. Marine Blue.

The most important brands for green shades are:—Methylene Blue B, MD, BH, and BZ.

For full reddish blues:—Marine Blue BN, RN.

For very red shades:—Marine Blue RRN.

The Methylene Blues were first produced by us, and we have had them on the market ever since 1878. They are of great importance for cotton dyeing, as the bright greenish blue shades obtained with them are exceedingly fast to light and washing.

The greener brands are the fastest to light, being somewhat better in this respect than the redder ones. The latter, however, appear as if they were somewhat faster than the former, as their shade is not changed as much by washing especially if a little alkali be present.

Toluidine Blue is similar in shade and properties to the Methylene Blues. It is, however, somewhat faster to light and washing.

All the products belonging to this group are exclusively used on a tannin-antimony mordant. For dark indigo-like shades a sumach-iron mordant can also be employed. In combination with other basic colours they are used to produce a large number of full fancy shades.

These products are not used for wool.

Other uses:—Large quantities of the Methylene and Marine Blues are used for calico printing (especially the brands BG, G, and BH which are free from zinc) and for dyeing cotton-silk unions. They also serve for dyeing linen, jute, cocoa-nut fibre, and silk.

Method of dissolving: In case of difficulty attend to note 5, page 4.

Dyeing process for cotton: No. 1 (a and b), page 165, and No. 6, page 179

» » » silk: No. 2, page 248 (also No. 4).

Nile Blue.

_Nile Blue A_
_Patent Nile Blue BB_
_Nile Blue R._

Nile Blue A, which is the oldest of the three brands, was placed on the market in 1888. The manufacture of Nile Blue BB, which is considerably greener, was commenced later on.

Both colours possess similar properties to those of the Methylene Blues. On tannin-mordanted cotton they give very pure greenish blue shades, which are comparatively fast to light and washing.

The newest brand, Nile Blue R, gives considerably redder shades, and is highly prized on account of its strength and low price.

These colours are also used for silk.

Dyeing process for cotton: No. 1 (a and b), page 165 and following pages
» » » silk: No. 1a, page 247 (also No. 4).

Victoria Green. Brilliant Green.

_Victoria Green extra, crystals_  _Brilliant Green II_
_Victoria Green O_  _Diamond Green B, crystals_
_Victoria Green I_  _Diamond Green G, crystals_
_Victoria Green II_  _Malachite Green B_
_Brilliant Green extra, crystals_  _Malachite Green G._
_Brilliant Green O_

The Victoria Green brands and Diamond Green B possess the same bluish shade, and only differ from each other in strength and form (large or small crystals or powder).

The comparatively cheapest of these products is Diamond Green B.

The same relationship also exists between the Brilliant Green brands and Diamond Green G, which are yellower in shade than the above bluish brands.

The comparatively cheapest of these colours is Diamond Green G.

The two Malachite Green brands correspond in shade with the Diamond Green brands that are marked with the same letters. They are, however, somewhat duller and are more difficult to dissolve, as they are zinc chloride double salts. At the present time these colours are of little importance, and in most cases they can be replaced with advantage by the crystalline brands.
Only very small quantities of the basic greens are used for wool dyeing. On the other hand, however, they are very extensively used for mordanted cotton, both as self-colours and in combination with other basic dyes. For example, with Auramine they give very bright green shades, with Methyl- or Crystal Violet cheap blue shades are produced which are fairly fast to washing. On cotton that has been mordanted with sumach and iron these colours give full Russian greens, &c.

It must not be forgotten that these basic greens are very sensitive to hard water (water containing lime salts). Such water should therefore always be corrected before use, by adding 1—1 1/2 pints of acetic acid 9 Tw. for every 100 gallons of water.

Other uses:—These colours also serve for printing cotton and for dyeing silk, jute, linen, and cocoa-nut fibre, &c.

The yellowish brand Diamond Green G is the most highly valued.

Method of dissolving: Where possible use distilled water. At all events attend to note 3a, page 3 (with Malachite Green also No. 6).

Dyeing process for cotton: No. 1 (a and b), page 165 and following pages
  >  >  > silk: No. 1a, page 247 (or No. 4)
  >  >  > wool: No. 2, page 99 and No. 11, page 112.

Jet Black. Jute Black.

Jet Black | Jute Black G
Jute Black | Jute Black N.

The colours are not used at all for wool, and only to a slight extent for silk or mordanted cotton. On the other hand, large quantities are consumed for dyeing jute, cocoa-nut fibre, &c. These materials do not require to be mordanted, and a good black is produced on cocoa-nut fibre, for example, with an average of 1—1 1/2 9/0 of dye.

They have almost entirely replaced logwood for the above purpose.

Jet Black, Jute Black, and Jute Black N are reddish brands and differ from each other more in strength than in shade.

Jute Black G is greener than the above.

Method of dissolving: Where possible use distilled water. At all events attend to note 3a, page 3.

Dyeing process for cotton: No. 1 (a and b), page 165 and following pages
  >  >  > silk: No. 1a, page 247 (also No. 4).
Dyes of the Eosine Group.

**Eosine** and similar dyes.

- Eosine A
- Eosine ML
- Eosine MLG
- Eosine C
- Eosine R
- Eosine RG
- Eosine B
- Eosine BN
- Erythrosine I
- Erythrosine IN
- Erythrosine extra yellowish
- Erythrosine extra bluish
- Phloxine BB
- Phloxine B
- Phloxine BJ
- Phloxine BBJ
- Phloxine G
- Phloxine H
- Phloxine BBN
- Phloxine GN
- Rose Bengal AT
- Rose Bengal NT
- Rose Bengal B
- Eosine soluble in spirit (see page 82).

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**Uranine A**

Iris Blue. (This colour is placed here for practical reasons.)

The colours of this group are extensively used on account of their beauty for cotton, wool, silk, &c.

For wool dyeing, however, they have been replaced to a great extent by Rhodamine, which is much faster to light.

The most important yellowish brand is:—**Eosine A**.

» » » medium blue brands are:—**Phloxine GN, BBN**.

» » » extra bluish brand is:—**Rose Bengal NT**.

**Eosine BN** is exceedingly strong but is somewhat duller in shade.

All of them are used for silk.
Dyes of the Eosine group.

Phloxine BJ, BBJ, and Rose Bengal B are special brands for cotton. The following are also suitable for this purpose, viz: Eosine A, BN, Erythrosine extra yellowish, extra bluish, Erythrosine I, Phloxine H, GN, G, BBN, &c.

Of course the shades produced with these colours on cotton are not fast to washing. In calico printing, the Eosines are extensively used on account of their bright shades. For prints which require to be faster they are fixed with chrome salts. This renders them faster to light and washing but impairs their brightness.

Uranine A is a greenish yellow-dye which is used for a number of special purposes on account of its fluorescence. It also serves for dyeing silk and for printing wool.

Dyeing process for wool: No. 4, page 103

> > silk: No. 1a, page 247 (or No. 4)
> > cotton: No. 5, page 160.

Iris Blue. This is used in the same manner as the basic Iris Violet for producing shot effects on silk, &c.

It is difficult to bring into solution, and therefore a large quantity of hot water must be used for dissolving it. All additions are useless.

Dyeing process for silk: No. 1a, page 247 (or No. 4).
Substantive Dyes.

Yellow.

Sulphine A
Sulphine N
Patent Cotton Yellow G
Patent Cotton Yellow GI
Patent Cotton Yellow G R
Patent Cotton Yellow GRR
Cotton Yellow R
Pyramine Yellow G

Patent Carbazole Yellow.

Yellow produced by developing diazotised Sulphine with chlorine, a soda solution
or with phenol
Yellow produced by developing Cotton Yellow G or GI with Nitrosamine solution.

Sulphine is only used in exceptional cases as a yellow dye. It generally serves for producing ingrain colours. (This is dealt with later on.)

Dyeing process for cotton: No. 1, page 143
>Dyeing process for silk: No. 4, page 249 (or No. 1a).

Cotton Yellow G was discovered by the Badische Anilin- & Soda-Fabrik in 1888. On cotton it gives a full greenish yellow which is very fast to light. In the latter respect it is superior to all other products of a similar shade that are to be found on the market at the present time.

Cotton Yellow GI has the same properties as the old brand. It has, however, the advantage of giving a full yellow, even when dyed a light shade with Glauber’s salt alone, without any addition of soap or sodium phosphate. When dyeing with these two products no soda must be added, at least if a greenish yellow is desired.

Cotton Yellow G R possesses the same properties as the brand GI but is considerably redder; GRR is redder still.

Medium shades that have been produced with the various Cotton Yellows, can be rendered sufficiently fast against bleeding into white by treating them with a solution of some copper salt, then rinsing and finally passing through a hot soap solution. This treatment also makes the shade considerably fuller.
When used for union goods, the Cotton Yellows dye the wool a little fuller than the cotton.

On wool they are dyed with an addition of Glauber’s salt. If hard water is used, a trace of acetic acid is finally added.

They are very extensively used for materials consisting of cotton and silk, and they are now quite indispensable for this purpose on account of their good properties.

They can also be employed for dyeing silk, but in this case their sensitivity to acids is a great drawback.

Other uses:—Cotton Yellow G, GI, GR, and GRR likewise serve for dyeing jute and linen.

Method of dissolving: Cotton Yellow Gr, GI, GR, and GRR are difficult to dissolve. It is best to use soft or even distilled water.

Dyeing process for Cotton Yellow G, GI, GR, and GRR:—
for cotton: No. 1d and 1c, page 144 (also No. 1g). For GI, GR, and GRR also No. 1a, page 143, in cases where this cannot be avoided.
» wool: No. 1, page 94. See appendix page 98.
» silk: No. 2, page 248.

Cotton Yellow R. At the present time this is the cheapest of our reddish yellows. It possesses the great advantage of being fast to acids.

Light shades which have been produced with this colour on cotton, are rendered fast against bleeding into white, by an after-treatment with copper salts.

It is specially adapted for dyeing union goods, as it gives a fuller shade on the cotton than on the wool.

Large quantities are used for dyeing silk, wool, and materials consisting of cotton and silk, &c., on account of the above-mentioned fastness to acids.

When dyeing cotton with this product it is not advisable to add any soda.

Dyeing process for cotton: No. 1a, page 143
» » wool: No. 1, page 94, with appendix page 98
» » silk: No. 4, page 249 (or No. 1a).

Pyramine Yellow G. This product gives clear, pure, and full shades which are fast to acids, comparatively fast to light and also cheap.

Pyramine Yellow G is only slightly affected by hard water or by water containing iron.

It is very well adapted for dyeing wool in a neutral bath.

Dyeing process for cotton: No. 1a, page 143

Carbazole Yellow. This is distinguished by dyeing very level shades which are very full overhand. It is not easily affected by alterations in the method of dyeing, and amongst other substances soda may be added to the bath when dyeing cotton.

It is a very valuable colour for wool, as the shades produced with it on this material are extremely fast to light.

Dyeing process for cotton: No. 1a, page 143

Dyeing process for wool: No. 1, page 94, with appendix on page 98. Also process No. 2, page 99, with appendix page 101 is extensively used.

Dyeing process for silk: No. 4, page 249 (or No. 3).

For the Yellow produced by developing diazotised Sulphine with chlorine, phenol, or phenol salt, also the Yellow obtained by developing Cotton Yellow G or GI with Nitrosamine solution, see page 75.

Orange.

| Patent Cotton Orange R | Orange-brown produced by developing Pyramine Orange 3G with Nitrosamine solution. |
| Patent Pyramine Orange 3G | |
| Patent Pyramine Orange R | |
| Patent Pyramine Orange RR | |
| Patent Salmon Red | |

Cotton Orange G and R both give very level shades, and for this reason they are very extensively used for dyeing fancy shades. When once fixed on the vegetable fibres they are fairly fast to washing. In this respect they are faster than the average of the substantive dyes. They are very suitable for dyeing union goods, as under the ordinary conditions of working they dye the cotton fuller than the wool.

These products are of no special interest for materials consisting of cotton and silk, but on the other hand they serve for dyeing silk. They are fast to acids.

Dyeing process for cotton: No. 1a and 1f, page 143 and 144

Dyeing process for wool: No. 1, page 94, with appendix page 98

Dyeing process for silk: No. 4, page 249 (also No. 1a).

Pyramine Orange 3G. On cotton, this colour gives shades which are yellower than the brands K and RR and which are very full overhand. It is very soluble, but not quite so fast to acids and chlorine as the above-mentioned brands.
Pyramine Orange R gives very bright shades which are comparatively fast to chlorine. It is readily taken up by cotton, and can therefore be used for dyeing very full shades.

This product is fast to washing and acids.

It is suitable for dyeing union goods, as it offers the same advantages as Cotton Orange G and R. On account of its fastness to washing on wool, it also serves for dyeing woollen yarn.

In addition to this it is used for dyeing materials consisting of cotton and silk, as in an alkaline soap bath it dyes the cotton fuller than the silk. It is also useful for dyeing pure silk.

Method of dissolving: Pyramine Orange R is difficult to bring into solution, and therefore a large quantity of hot water should be used, or the colour should afterwards be brought into solution in the dye-liquor.

Pyramine Orange RR. In most properties this brand is very similar to the one just described, but it is much easier to dissolve. The shade of RR is somewhat redder, and full dyeings produced with it are deeper in tone. It is also cheaper.

As it dyes very level it can be used for producing light fancy shades on cotton.

The various Pyramine Oranges give very full shades on wool which are fast to washing. For this reason they are specially adapted for dyeing woollen yarn.

Dyeing process for RR, R, 3G on cotton: No. 1a, page 143. For cream shades, &c. also No. 1c, page 144.

Dyeing process for wool: No. 1, page 94, with appendix page 98.

(Process No. 2, page 99, with appendix page 101 is also largely used.)

Dyeing process for silk: No. 4, page 249 (also No. 1a).

Salmon Red. When dyed in light shades on cotton (1/20 — 1/10 %) this colour gives delicate flesh shades. It is therefore very suitable for producing light ground colours, and for dyeing hosiery goods. This product is a very strong colour and exhausts well even in dark shades. Like all other substantive dyes, it gives shades on wool which stand milling well. They are also very fast to light in comparison with other colours of this group. On this material it gives an orange of good covering power. It is also used for dyeing silk.

Dyeing process for cotton: No. 1e, page 144

> > > wool: No. 1, page 94, with appendix, page 98

> > > silk: No. 2, page 248.

For Orange produced by developing diazotised Sulphine with Resorcin, and orange-brown produced by treating Pyramine Orange 3 G with Nitrosamine solution, see pages 75 and 79.
Brown.

| Thiazine Brown G | Brown produced by developing diazotised Sulphine with Oxamine Developer M. |
| Thiazine Brown R | Brown produced by developing Cotton Black B or BN with Nitrosamine solution. |
| Patent Cotton Brown G | |
| Cotton Brown RN | Dark red-brown obtained by developing Oxamine Maroon with Nitrosamine solution. |
| Cotton Brown RV | |
| Oxamine Brown M | |
| Oxamine Brown MNI | |
| Copper Brown | |
| Patent Oxamine Maroon. | |

Thiazine Brown G and R dye very even light and medium shades; they are also very cheap and are fairly fast to acids. For the above reasons they are very extensively used in cotton dyeing.

By an after-treatment with copper salts, they can be made faster to bleeding into white and also faster to light.

Both products are suitable for dyeing union goods, as they dye the cotton a fuller shade than the wool. They are of little interest for materials consisting of cotton and silk, but on the other hand they are very suitable for dyeing pure silk.

Dyeing process for cotton: No. 1a, page 143
  » » » wool: No. 1, page 94, with appendix page 98
  » » » silk: No. 1b, page 247 (or No. 4).

Cotton Brown G. On cotton this product gives leather brown shades such as are highly valued in the hosiery industry. It also dyes very evenly.

Cotton Brown RN. This product has more affinity for cotton than Thiazine Brown R, and is very similar to it in shade. It is therefore used in place of the latter for dyeing full shades. This brand stands acids well and gives level shades. It is also cheap and the shade is only slightly altered by drying.

Cotton Brown RV is very similar to Cotton Brown R in properties but differs from it in shade, as it is more of a tobacco brown.

The Cotton Browns are not suitable for dyeing union goods, or for materials consisting of cotton and silk. On the other hand they are used for dyeing pure silk.

Dyeing process for cotton: No. 1a, page 143
  » » » wool: No. 1, page 94, with appendix page 98
  » » » silk: No. 1b, page 247 (or No. 4).
Oxamine Brown M is used specially for producing full tobacco brown shades on cotton, as it is very strongly attracted by this fibre. The price of this colour is also in its favour.

Oxamine Brown MNI is a newer brand which is very similar in shade and strength to the above, but it possesses better dyeing properties and it is also very cheap. In most cases the older brand can be replaced to advantage by this colour.

Copper Brown. This colour was introduced specially for dyeing linen plush, in which branch copper coloured shades play a very important part. It is, however, also suitable for cotton dyeing, and is valued for this purpose. For many purposes Copper Brown can be directly replaced by Cotton Brown RN.

Dyeing process for cotton: No. 1a, page 143
  »  »  »  silk: No. 1b, page 247 (also No. 4).

Oxamine Maroon is a single substantive dye which is very similar in properties to our Oxamine Red. It has the same property as the latter colour of being strongly attracted by the vegetable fibres, so that even the darkest shades can be produced with it.

Oxamine Developer M, see page 75.

For brown produced by developing diazotised Sulphine with Oxamine Developer M, see page 79.

For brown produced by developing Cotton Black B or BN with Nitrosamine solution, see page 79.

For dark reddish brown produced by developing Oxamine Maroon with Nitrosamine solution, see page 79.
Thiazine Reds G and R give very bright pink shades on cotton, but they are not suitable for dyeing a very full red requiring more than 1 1/2% of colour.

The shades obtained in this manner are fast to acids and comparatively fast to light.

The dyes of this group are also extensively used for wool dyeing, in particular for flannel and fez, as they are specially suitable for this purpose and are cheap. If when dyeing wool with these colours, 1/12—1/5 oz. of copper vitriol is added for every gallon of liquor in the dye-bath, and the boiling continued for another 1/2 hour, shades are obtained which vary from a dull deep red to the deepest claret, depending on the amount of metal salt used.

Such dyeings are exceedingly fast to light, being faster in this respect than any others which can be produced with Aniline Colours. Thiazine Red GW and RW are special brands for dyeing wool. Both give essentially brighter shades than Thiazine Red G and R. On the other hand the latter are better suited for use on cotton. The Thiazine Reds are very suitable for producing light shades on union goods, but they are of little interest for dyeing materials consisting of cotton and silk. On the other hand they are used for dyeing silk.

Dyeing process for cotton: No. 1a, page 143
Dyeing process for wool: No. 1, page 94, with appendix page 98
Dyeing process for silk: No. 1b, page 247 (also No. 4).

Cotton Red 4 B and 4 B extra only differ from each other in strength. Both products have the same composition as Benzopurpurine 4 B, which has been on the market for many years past. They can therefore always be used for the same purposes as the above. They are very extensively used for dyeing
cheap cotton flannel, &c., but recently they have been again replaced to a great extent, by the perfectly fast Turkey Red, formerly generally used for these goods.

The Cotton Reds give cheap bright shades, and for many purposes where not much is demanded they are also fast enough to washing. A great drawback, however, is that one cannot prevent them bleeding into white when washed, and they stand acids and exposure but poorly.

*Cotton Red 4B* is also suitable for dyeing wool, silk, union goods, and materials consisting of cotton and silk.

**Method of dissolving:** Where possible use soft water. If this cannot be obtained attend to note 3 b, page 3.

*Dyeing process for cotton:* No. 1 e, page 144

» » » wool: No. 1, page 94, with appendix on page 98

» » » silk: No. 2, page 248.

**Cosmos Red, Cosmos Red extra.** These products only differ from each other in strength. Like *Cotton Red 4B* and *4B extra* they serve for producing cheap reds on cotton in an easy manner. They are not even as fast to light and acids as Cotton Red.

These colours also serve for dyeing wool, silk, &c.

*Dyeing process for cotton:* No. 1 a, page 143

» » » wool: No. 1, page 94, with appendix page 98

» » » silk: No. 2, page 248.

**Cotton Red S.** This dye resembles *Cotton Red 4B* in shade but is faster against acids. On the other hand it is dearer and it must be dyed according to special process. It is therefore only used for dyeing goods which need to possess fastness to acids.

*Dyeing process for cotton:* No. 1, or rather appendix to this on page 156.

For red produced by developing diazotised Sulphine with Beta-Naphthol,

see page 76.
Dark Red. Claret.

**Patent Oxamine Red**
**Oxamine Claret M**
**Oxamine Garnet M**
**Cotton Corinth G**

**Bluish red, claret, and red-brown**
produced by developing diazotised
Sulphine with Alpha-Naphthol
or Oxamine Developer B, or by
developing Oxamine Red with
Nitrosamine solution.

**Oxamine Red** is extensively used for dyeing full shades on cotton. For this purpose it can be used to advantage, even for the deepest shades, as this product is still attracted by the fibre when other dyestuffs refuse to exhaust. It is also fairly fast to acids. The dyeings produced with this colour can be made faster against bleeding into white by treating them with a solution of copper sulphate.

Oxamine Red is also used for wool, but only to a limited extent, as the shade is rather dull for this purpose.

It is very suitable for dyeing union goods, silk, and materials consisting of cotton and silk.

**Oxamine Claret M** and **Oxamine Garnet M** are similar in properties to **Oxamine Red**, and on cotton they are used for the same purposes.

They are also suitable for dyeing unions, although they dye the cotton somewhat bluer than the wool. (In many cases this is a great advantage, as if the cotton warps in unions are kept a little bluer than the wool, they are not so conspicuous.)

These products are not suitable for dyeing materials consisting of cotton and silk, but they serve for dyeing silk.

**Dyeing process for cotton**: No. 1a, page 143

**Dyeing process for wool**: No. 1, page 94, with appendix page 98. (For Oxamine Red also No. 2, page 99, with appendix page 101.)

**Dyeing process for silk**: No. 4, page 249 (also No. 1).

**Cotton Corinth G.** On cotton this colour gives very bluish claret shades, and it is used for the same purposes as the above-mentioned products.

It is suitable for dyeing unions and materials consisting of wool and silk.

**Dyeing process for cotton**: No. 1b, page 144

**Dyeing process for silk**: No. 2, page 248.

For **claret**, **bluish red**, and **red-brown** shades, produced by developing diazotised Sulphine with Alpha-Naphthol or Oxamine Developer B, or by developing Oxamine Red with Nitrosamine solution, see pages 75, 76, and 79.
Violet.

Patent Oxamine Violet.

Considering its strength Oxamine Violet is a very cheap product. For the above reason, and on account of its good properties it is extensively used for producing fancy shades on cotton.

It is very strongly attracted by cotton and possesses good fastness to acids. This colour is also suitable for dyeing unions and materials consisting of cotton and silk, as it always dyes the cotton the darker shade. It can also be used for dyeing silk.

For the properties of the fast blue shades that are produced by developing diazotised Oxamine Violet, see page 77.

Dyeing process for cotton: No. 1a, page 143
  »  »  » wool: No. 1, page 94, with appendix page 98
  »  »  » silk: No. 4, page 249 (or No. 1a).

Blue.

Patent Oxamine Blue G  Phenamine Blue B
Patent Oxamine Blue BG  Phenamine Blue R
Patent Oxamine Blue B  Blue produced by developing
Oxamine Blue A  diazotised Oxamine Violet
Patent Oxamine Blue RX  or Oxamine Blue RRR
Patent Oxamine Blue RXN  with Beta-Naphthol, Alpha-
Oxamine Blue RRR  Naphthol, Oxamine Deve-
Phenamine Dark Blue MN loper B or Oxamine Deve-
Phenamine Blue G  loper R.

The chief difference between the various Oxamine Blues is in shade, in general properties they are all about the same.

Oxamine Blue G yields the greenest shades of any dyes of this group which are at present on the market.

Oxamine Blue BG comes between G and B in shade, and covers somewhat more. It is very easily soluble, very readily yields level shades, and is at the same time cheap. Upon after-treatment with sulphate of copper, bichromate of potash and acetic acid (process page 199) the fastness against washing is essentially improved, whilst, however, the shade itself is distinctly changed towards reddish blue.
Oxamine Blue B is redder than the above mentioned brand. It is extensively used in combination with Cotton Yellow G and GI for producing bright green shades.

It is a little more difficult to dissolve than the brands G mentioned hereafter, and this fact must be borne in mind when working with it.

Oxamine Blue RRR is the reddest of the Oxamine Blues, and the brands A, RX, and RXN stand in shade between it and B.

The brands RRR, RX, RXN, and A possess good dyeing properties and are very cheap, and for these reasons are very extensively used. RXN is slightly duller in shade but essentially cheaper than RX. The shades obtained with Oxamine Blue A can be made very fast to light by the subsequent treatment with copper sulphate.

The shades produced with the Oxamine Blues on cotton are fast to acids, and their fastness to light is above the average.

Oxamine Blue BG and RRR can be diazotised and developed on the fibre. The former yields, particularly with Oxamine Developer R, valuable violet shades with good covering power. With a solution of Nitrosamine it yields a well covering green possessing good fastness to washing.

With Oxamine Blue RRR the shades produced are not so full as those obtained from Oxamine Violet, but they are clearer, and for this reason they are preferred for several purposes. See page 79.

For wool dyeing the most suitable brands are B and RX. They are all used for dyeing silk, jute, union goods, and materials consisting of cotton and silk. The Oxamine Blues, especially the brand RRR, are used in large quantities for topping cotton, linen, and half-linen piece-goods which have been grounded with indigo.

Dyeing process for cotton: No. 1a, page 143. (For light shades also No. 1c.)
Dyeing process for wool: No. 1, page 94, with appendix page 98. (Also process No. 2, page 99, with appendix page 101.)

Dyeing process for silk: No. 4, page 249 (also No. 1a).

Oxamine Dark Blue MN. This product is very similar in properties to Oxamine Blue RRR. It serves chiefly for producing very full navy blue shades on cotton, similar to those obtained from indigo.

Dyeing process for cotton: No. 1a, page 143
Dyeing process for wool: No. 1, page 94, with appendix page 98
Dyeing process for silk: No. 4, page 249 (or No. 1a).
Phenamine Blue G, B, R. These colours are distinguished by giving very level shades.

They are also very cheap, they have great covering power, and are very strongly attracted by cotton. For these reasons they can be used for producing exceedingly full shades. They are suitable for producing all kinds of fancy shades on cotton, and are generally better adapted for this purpose than the Oxamine Blues.

The most important brand is Phenamine Blue B, whereas G is chiefly used for producing greener and purer shades.

If subjected to an after-treatment with copper salts, these blues become duller in shade, but their fastness to light and washing (especially with regard to bleeding into white) is further improved.

Other uses:—The Phenamine Blues are also suitable for wool dyeing, but they are of no special importance for either wool and cotton unions or for materials consisting of wool and silk.

On the other hand they are valuable colours for dyeing silk.

Dyeing process for cotton: No. 1b, page 144 (also No. 1a)
>  >  >  silk: No. 4, page 249 (also No. 1a)
>  >  >  wool: No. 2, page 99, with appendix page 101 (also No. 1, page 94, with appendix page 98).

For blues produced by developing Oxamine Blue RRR and Oxamine Violet, see pages 77—79.

Green.

Oxamine Green MN
Oxamine Dark Green MN.

These colours are used for producing green shades on cotton.

Oxamine Green MN is considerably yellower and brighter than Oxamine Dark Green MN. Both products exhaust well and are comparatively fast to light. They are also faster to washing than many of the substantive dyes.

If medium shades that have been produced with these colours (up to about $2^{1/2} \text{ o/o}$ of dye) are treated with sulphate of copper, bichromate of potash and acetic acid (process page 199), rinsed, and then treated with a warm soap solution, they become much faster against bleeding into white. The shade is rather considerably changed by this treatment.
If a yellower shade is required, Cotton Yellow GI is used for shading off. These colours can also be topped with the basic greens, or if better fastness to light is desired, a mixture of Auramine, and Methylene Blue is used.

_Oxamine Green MN_ also serves for dyeing materials consisting of wool and silk.

Method of dissolving: If possible use soft or distilled water.

Dyeing process for cotton: No. 1c, page 144 (or No. 1d)

- Oxamine Green MN on silk: No. 2, page 248 (if necessary also No. 4)
- Oxamine Green MN on wool: No. 1, page 94, with appendix page 98.

**Black.**

_Patent Violet Black_  
_Patent Cotton Black B_  
_Cotton Black 3 B_  
_Cotton Black BN_  
_Patent Cotton Black C_  
_Patent Cotton Black G_  
_Patent Cotton Black GG_  
_Patent Cotton Black R_  

_Patent Grounding Black for Cotton_  
_Patent Grounding Black for Cotton 4B_  
_Patent Union Black B_  
_Patent Union Black BB_  
_Patent Union Black 4B_  
_Patent Oxamine Black A_  
_Patent Oxamine Black N_  
_Patent Burl Black_.

**Violet Black.** This product gives perfectly level dyeings, even when used for the lightest shades. It also exhausts very well in dark shades.

_Violet Black_ stands acids well and is moderately fast to light; it is extensively used as a ground for basic colours, Aniline Black, and Indigo.

When dyed on wool, it gives shades which are fast to milling but not to light.

It can be used to advantage for union goods where the wool requires to be darkened in a cheap manner, as it dyes the wool fuller than the cotton.

It is also used for dyeing silk.

Method of dissolving: If possible use soft water. (If it is intended for dyeing cotton attend to note 3b, page 3.)

Dyeing process for cotton: No. 1a, page 143

- wool: No. 1, page 94, with appendix page 98. (Also No. 2, page 99, with appendix page 101.)

Dyeing process for silk: No. 4, page 249 (or No. 1a).
Cotton Black B. When dyed on cotton as a self-colour, or in combination with Pyramine Orange 3G, this product gives full black shades which are fast to acids.

The frequently desired bluish black can easily be obtained by adding a little Methylene Blue to the second rinsing bath.

Cotton Black BN. This new brand is very readily soluble and at the same time of a more bluish shade than B. The colouring power is the same. Cotton Black BN can be used for covering the cotton in woollen and cotton unions in the mill. The pieces so produced withstand the subsequent dyeing, in the acid bath, well so long as only light or medium shades are dyed.

Cotton Black C is cheaper than Cotton Black B and BN but it is also weaker. In all other respects they are the same.

Cotton Black G and Cotton Black GG give deeper and more jetty blacks than the above brands, but they possess the same general properties.

Cotton Black 3B. This product takes the place of Cotton Black B or BN in cases where a bluer shade of black is desired. In other properties it is similar to the brand BN and it also possesses the same colouring power.

Cotton Black R. This product dyes reddish black shades on cotton. If these are topped with Methylene Blue, more beautiful blacks are obtained than those produced in a similar manner from Cotton Black B.

This method of working is chiefly used for poorer qualities of hosiery goods.

Cotton Black 3B, BN, B, and C, and the very similar Grounding Black for Cotton are of special interest for dyeing unions. The latter product is the most suitable for this purpose.

The method of working can be so regulated that the cotton and wool are both dyed the same shade, or if necessary the cotton can be dyed considerably darker than the wool. In the latter case, by adding a suitable acid dye (e.g., Palatine Black 4B), it is possible to dye the cotton with a substantive colour, whilst the wool is chiefly dyed with an acid black which is faster.

Cotton Black BN, B, and C are also adapted for dyeing silk and materials consisting of cotton and silk.

For black and brown shades produced by developing this colour on the fibre, see page 79.

Dyeing process for cotton: No. 1b, page 144.
Oxamine Black N, A. These products differ only in possessing different colouring power. The ordinary commercial brand is Oxamine Black N. This yields good, level, full-bodied shades of blue on cotton which possess about the same fastness as our other substantive blues. On cotton and wool unions Oxamine Black N gives a greenish dark blue of comparatively good fastness against light. The cotton and the wool are dyed to approximately the same depth.

Oxamine Black is principally used for the production of black shades by further development. These possess great fastness (see page 79 for this process).


Dyeing process for wool: No. 4, page 249.

Grounding Black for Cotton 4 B is chiefly used for dyeing union goods. When correctly dyed in one bath, the wool should be slightly yellow and the cotton a full bluish black. Very beautiful black shades can be obtained on union goods, by using this colour in conjunction with a blue or black that will dye wool in a neutral bath. (Neutral Blue for Wool, Palatine Black 6 B.)

Grounding Black 4 B is extensively used for producing two-coloured effects on unions (black cotton and brightly coloured wool).

Dyeing process for cotton: No. 1b, page 144. (In case of need also No. 1a)
  »  »  » silk: No. 2, page 248 (or No. 1a)

Union Black B. If union goods that are free from acid, are dyed with this colour in a neutral bath, full, level, and bright shades are obtained which are fairly bright overhand. As it is very easy to work with, it is extensively used for dyeing old clothes.

Union Black BB gives brighter and bluer shades than the above brand. Union Black B is used for all kinds of union goods, whereas BB is generally applied to goods containing dark-coloured shoddy.

Union Black 4 B is the bluest of our brands at the present time, and it gives the most beautiful black shades.

Its chief application is for ladies' clothing materials (figured union goods and the like) but it is also used for other purposes.

Dyeing process for unions: see page 294 and following pages.
Patent Burl Black. This product is not intended for covering burls in pieces which have been already dyed but for producing black shades on pieces which only contain a few burls which simply require to be slightly blued in order to render them less noticeable.

Pieces which contain many burls should be dyed with Union Black instead of with Burl Black, or one can first dye the wool with Palatine Black and cover the cotton with Grounding Black for Cotton or with tannin and iron.

Dyeing process for wool: No. 2 with appendix on page 100.

The following products may also be considered as substantive dyes.


The Fast Blacks dye unmordanted cotton and other vegetable fibres cold. They must, however, be dyed under special conditions, and cannot be used direct in conjunction with other dyes.

They have the advantage over Aniline Black that the fibre dyed with them retains to the full its original strength. The Fast Blacks are also fast to washing, light, and air.

These colours are also sufficiently fast to acids to permit their use for cotton warps which are intended for union goods, the wool of which has afterwards to be dyed in an acid bath. Fast Black must not be used for dyeing the warps of unions, the wool of which requires to be afterwards mordanted with chrome compounds or dyed with an addition of such to the dye-bath.

The method of dyeing with Fast Blacks is extremely simple.

Dyeing process for cotton: page 155.

Anthraquinone Black. This product gives more beautiful and faster shades than Fast Black, and it is still easier to work with.

It may be used for dyeing the warps intended for union piece-goods, as it is fast to acids, but it is liable to bleed a little into the wool when topping with acid dyes. (It is better to use Kryogene Black B or Fast Black for this purpose when very delicate shades are required.)
Experiments on a large scale have proved that it is quite possible to dye union goods with *Anthraquinone Black* by the one-bath process. The chief condition is that the dyeing must take place at a very low temperature.

At the present time, however, this product is too expensive for this purpose.

Dyeing process for cotton: No. 1 with appendix page 152.

**Kryogene Black B, G, BX, and GX.** These brands mark a further improvement in the class of sulphur dyes for cotton, especially in shade, colouring power, and favourable price.

*Kryogene Black B* has a bluish shade and, when dyed and brightened in the proper way, it resembles in shade Aniline Black obtained by oxidation. *Kryogene Black G* yields a good covering deep black shade. *Kryogene BX* and *GX* differ solely from *B* and *G* respectively in possessing greater colouring power.

Both *Kryogene Black B* and *G* possess an excellent degree of fastness, provided the dyed goods are after-chromed; and in particular, the fastness against boiling acid liquids, which permits of their application for dyeing plush-warps, should be mentioned. If the goods need not possess this fastness, it is in many cases unnecessary to subject them to the after-treatment with bichromate, as in other respects the fastness is very good even without this treatment. The shade of dyeings which have not been chromed change somewhat on storing for a long period. In the above case, for example, they become a little bluer. Dyeings which have been chromed are much better in this respect, they only change very slightly. It is, of course, desirable that in every case a suitable test be made.

*Kryogene Black B* possesses further special advantages for use as a fast ground for indigo, for goods dyed with it attract the indigo from the vat more strongly than does cotton grounded in a similar way with other dyes.

Dyeing process for cotton: Process 1, or supplement to it on page 153.

**Kryogene Black BA, BAX.** These brands are especially used for dyeing loose cotton. *Kryogene Black G* can also be used for this purpose. They yield a more covering black shade than *Kryogene Black B* and are usually used without after-treatment with bichromate, the goods being only treated with lard in the usual way. (The change of shade which takes place on storing has already been described.) *Kryogene Black BAX* differs only from *BA* in possessing greater colouring power.

**Kryogene Brown.** As this product is exceedingly fast, cheap, and easy to work with, it has rapidly found extensive application in cotton dyeing, as a substitute for cutch, wood colours, and the ordinary substantive dyes. It is specially suitable for producing a ground which has to be topped with basic dyes and it can also be dyed direct with substantive dyes in one bath. *Kryogene Brown* is highly prized for dyeing cords. It may be dyed either hot or cold.

**Kryogene Brown G.** This new product is yellower in shade than the above. The shade is so extremely full, especially when seen over-hand, as to render this dyestuff comparable in this respect with the basic colours. The degree of fastness is also very good and it dyes sufficiently level shades especially if enough sodium sulphide is added to the dye-bath.

*Dyeing process for cotton: No. 1 with appendix page 150. (Also see page 208.)*

**Kryogene Blue G and R.** Of these colours *R* is the reddest and clearest, whereas *G* is greener and fuller. They are both dyed cold.

The Kryogene Blues are not so fast as the above-described black and brown sulphur dyes.

*Dyeing process for cotton: No. 1 with appendix page 152.*

**Kryogene Olive.** This new dyestuff gives full olive shades which possess a good fastness to washing, &c. Its property of dyeing level shades is above the average of the sulphur dyes.

The shade of dyeings produced with *Kryogene Olive* becomes grayer if they are stored for a long time. Up to the present we have not been able to discover a method of counteracting this.

*Dyeing process for cotton: Appendix to method I, page 152 and following pages.*
Mordant Dyes.

Dark Green, paste.

This product gives full green shades on cotton and linen that have been mordanted with sumach and iron, and also on silk. Such dyeings are sufficiently fast to washing, and they are also very fast to light.

The presence of iron is absolutely necessary for producing this green shade. It is only the iron lake which possesses this colour, whereas the original product is yellowish.

_Dark Green_ is used for dyeing linen and half-linen apron cloths, &c. When used for the above purpose it is generally brightened by topping it with some basic green and yellow.

On chrome-mordanted wool it gives fast brown shades. A similar brown which is extremely fast to washing is also produced by printing it on calico in combination with alkalis (ammonia, caustic soda, &c.).

Dyeing process for cotton: No. 1, page 165 and following pages, with note e, page 173

» » » wool: No. 5, page 104 (brown shades)

» » » silk: No. 5, page 249 (on silk that has been mordanted with iron).
Developed Dyes or Ingrain Colours.

To this group belong in the first place those substantive dyes which can be diazotised on the fibre and then developed with certain substances.

The new dyestuffs so produced differ chemically from the original ones. As a rule the shade is very much altered, and the dyeings always possess different properties.

Sulphine diazotised on the fibre and developed with:—

a) soda or soap
  (gives old gold shades)
b) bleaching powder
  (gives orange yellow shades)
c) Phenol
  (gives orange yellow shades)
d) Resorcin
  (gives orange shades)
e) Oxamine Developer M
  (gives brown shades)
f) Alpha-Naphthol
  (gives full red shades)
g) Beta-Naphthol
  (gives bright red shades)
h) Oxamine Developer B
  (gives bluish red shades).

The ingrain colours obtained in this manner, do not bleed into white when washed or only to such a small extent as scarcely to be of any practical importance.

The following are the most important of these developed colours:—

Sulphine diazotised and developed with bleaching powder or sodium hypochlorite solution. The shade becomes redder and fuller, and the colour obtained in this manner is very fast to chlorine and washing, also as regards bleeding into white.
Sulphine + Oxamine Developer M gives a full copper brown. It is not perfectly fast against bleeding into white, but still it is much better in this respect than the ordinary substantive browns.

Sulphine + Beta-Naphthol gives a red which is fairly fast to acids and washing, and is extensively used for cotton. Large quantities of warps for plush are dyed in this manner which were formerly dyed with sandal-wood exclusively. This colour is very valuable for dyeing the decorative threads that are used in woollen piece-goods.

It is specially suited for this purpose as it is fairly fast to air, and remains sufficiently unaffected when the wool is afterwards dyed in the piece.

If the red obtained in this manner from Sulphine, is dulled a little by treating it with a solution of copper sulphate, the shade becomes still more similar to that obtained from sandal-wood. It is also rendered faster to light and against bleeding into white.

This colour is of no special interest for wool or union goods. It can also be produced on silk and on materials consisting of silk and cotton, and is a valuable colour for the former article on account of its fastness to water and milling.

Sulphine + Oxamine Developer B. In this manner bluish red shades are obtained, which are much faster to washing than any similar shade which can be produced with any other Aniline Colours. In the above respect they are faster than those obtained with Beta-Naphthol, but they are not so fast to light.

Most of the ingrain colours of Sulphine can be rendered faster against bleeding into white when washed, by treating them with a solution of copper sulphate. Some of them are also made faster to light in this manner.

The improvement is very considerable in the case of Sulphine + soda or + Resorcine or + Beta-Naphthol.

Dyeing process for the various Sulphine combinations:
for cotton: No. 1a, page 143, or process B, page 190 and following pages
for silk: No. 4, page 249 (or No. 1a).

Sulphine diazotised and developed in a soda or soap bath. This method of working is of special interest for silk, and on this material it gives full and fast golden yellow shades.

Dyeing process for cotton: No. 1a, page 143, or process B, page 184, with details on page 190 and following pages.
Dyeing process for silk: No. 4, page 249 (or No. 1a).
Developed Dyes or Ingrain Colours.

**Oxamine Violet** diazotised and developed on the fibre with:

- **a)** Alpha-Naphthol (gives a dark reddish blue)
- **b)** Beta-Naphthol (gives a dark greenish blue)
- **c)** Oxamine Developer B (gives a very greenish dark blue)
- **d)** Oxamine Developer R (gives a dark greenish blue)
- **e)** Oxamine Developer M (gives a dark bluish green)
- **f)** Alpha-Naphthylamine hydrochloride (gives a dark reddish blue).

These ingrain colours are fast enough for practical purposes against bleeding into white when washed. The best in this respect is *Oxamine Violet + Oxamine Developer B*, which under normal conditions of working does not bleed at all.

The following are the most important:

**Oxamine Violet + Alpha-Naphthol.** This combination gives a blue which is redder, but not quite so fast as that produced with Beta-Naphthol. It only comes into question, therefore, when the redder shade is desired.

**Oxamine Violet + Beta-Naphthol** is by far the one most frequently used, because it possesses advantages in respect to shade, cost of production, and general properties. The blue obtained in this manner is very full in dark shades, and is very similar to indigo.

It is sufficiently fast to light and against bleeding into white for most purposes. It is extensively used for dyeing plush warps, as it is very fast to acids.

**Oxamine Violet + Oxamine Developer B.** This combination is used in preference to that with Beta-Naphthol when a very greenish blue is desired, also when intended for plush warps which require to be as fast to steaming as possible, or where the colour requires to be as fast as possible against bleeding into white.

The dyeings obtained with Beta-Naphthol are, however, faster to light.

Most of the shades obtained by developing Oxamine Violet, are rendered faster to light or against bleeding into white by treating them with a solution of copper sulphate.

This is especially the case with *Oxamine Violet + Beta-Naphthol* or *Oxamine Developer B.*
Oxamine Blue RRR can also be developed on the fibre by using the same substances. The shades produced are very similar to those obtained from Oxamine Violet, but they are without exception brighter and not so full.

The dyeings obtained from Oxamine Blue RRR + Beta-Naphthol are very important on account of their beautiful blue shade, also those which are produced from Oxamine Blue RRR + Oxamine Developer B, which are still greener.

Dyeing process for the various ingrain colours of Oxamine Violet and Oxamine Blue RRR:

for cotton: No. 1a, page 143, or process B, page 184, with details on page 190 and following pages.
for silk: No. 4, page 249 (or No. 1a).

To this group may also be added a series of substantive dyeings which are, however, not diazotised and developed on the fibre, but are simply treated without any preparation with a diazotised developer.

Oxamine Blue BG.

As already mentioned on page 66, this colouring matter can be both diazotised and developed with the usual developers, and it can also be combined with Nitrosamine solution.

According to the first process the most valuable combination appears to be that with Oxamine Developer R. Full bodied violet shades are obtained possessing good fastness against washing and against bleeding into the white.

If Oxamine Blue BG be developed on the fibre with Nitrosamine solution full bodied green shades are obtained which also possess good fastness to washing.

Dyeing process for cotton: No. 1a, page 143.
Process for diazotising and developing: page 190 and following pages.

Oxamine Black N, A.

If diazotised on the fibre and developed with Oxamine Developer M and a little soda, black shades are produced which are remarkably fast to washing, against bleeding into white, boiling in acid liquors, and also comparatively fast to light.

If in place of Oxamine Developer M a solution of Beta-Naphthol in caustic soda is used, full blue shades possessing similar properties are obtained.
Developed Dyes or Ingrain Colours.

These two processes can be combined without any difficulty, i.e., mixed solutions of Beta-Naphthol and Oxamine Developer M can be used.

If the blues obtained from Oxamine Black N or A by developing them with Beta-Naphthol be treated in the ordinary way with copper sulphate they are rendered considerably faster to light.

Oxamine Black dyed on silk also possess a good fastness to washing, &c.

Dyeing process for cotton: No. 1b, page 144. With reference to developing on the fibre, see page 190 and following pages.

Cotton Black 3B, BN, B, C, or Grounding Black for Cotton developed with Nitrosamine solution.

The above mentioned colours are dyed in the usual manner (process No. 1a, page 143), rinsed slightly, and then developed with Nitrosamine solution (process No. 3, page 193). The black-brown shades so obtained are exceedingly fast to washing and also against bleeding into white. Cheap and comparatively fast blacks can be obtained by adding some Methylene Blue or Nile Blue R to the bath after the development with Nitrosamine is complete.

If dyed direct, Cotton Black 3B gives a more beautiful black than any of the above mentioned brands.

Oxamine Red or Oxamine Maroon developed with Nitrosamine solution.

If dyeings obtained with Oxamine Red or Oxamine Maroon are treated in the same way (process No. 3, page 193) full claret or red-brown shades are obtained. Such colours are not perfectly fast against bleeding into white, but they become sufficiently fast in this respect if treated in the ordinary manner with a solution of copper salts. This can be carried out in the Nitrosamine bath.

Pyramine Orange 3G developed with Nitrosamine solution.

In this case brownish orange shades are obtained which are very fast to washing in comparison with similar dyeings (process No. 3, page 193).
Cotton Yellow G or GI developed with Nitrosamine solution.

The shade and fastness of dyeings produced with Cotton Yellow G and GI are not altered very much by treating them with Nitrosamine solution. If, however, this is followed by a treatment with copper sulphate solution, full yellow shades are obtained which are much faster to washing.

These colours are therefore specially adapted for shading the brown or claret shades produced from Cotton Black or Oxamine Red by developing with Nitrosamine solution and treating with copper sulphate.

Dyeing process for cotton: No. 1a, page 143.
Developing process with Nitrosamine solution: No. 3, page 193.

General Notes on the above combinations.

The developed substantive dyes are mostly used for cotton. They also serve for producing shades on silk which are fast to milling and water. As a rule, this method is too complicated and too expensive to be used for union goods, or materials consisting of cotton and silk.

Cotton Black B and Oxamine Red developed with Nitrosamine solution are, however, exceptions, as they are also used for union goods.

An example of the third group of developed dyes, i.e., those for which no colouring matter is used,—the colour being built up on the fibre itself—is Nitrosamine Red.


This product is used for the same purpose as Paranitraniline, but it is much easier to use and more reliable. It is also cheaper than any other substitute.

As far as red shades are concerned, it is almost exclusively used for dyeing and printing cotton.
The red produced in this manner, is the nearest approach to Turkey Red which is obtained from Alizarine. It serves as a substitute for the latter for goods which do not require to be as fast as possible to light and washing.

Dyeing process for cotton: Appendix page 488. Also compare general remarks, page 184—186.

If silk is dyed direct with Nitrosamine Red paste, i.e., without previous preparation with Beta-Naphthol, full yellow-orange shades are obtained which are extremely fast to washing.

When used in the same manner as for cotton, i.e., if the fibre is first impregnated with Beta-Naphthol and then developed with Nitrosamine solution, full red shades that are fast to washing and water are produced. (Of course, the silk that has been treated in this manner has no scroop.)

Dyeing process for yellow with Nitrosamine Red on silk: No. 3, page 248 (or No. 4).

An example of a dyeing process which does not depend on the use of diazotised substances, but on an oxidising action, is Aniline Black.

**Aniline Black.**

The properties of this colour are already well-known. Details of the dyeing process are given on page 187 and following pages.

This colour is being continually replaced by the sulphur dyes which give a direct black, and the substantive dyes which give a black when developed on the fibre. The reason for this is, that the “one-bath” black is not sufficiently fast to rubbing, and the black produced by oxidation (two baths) requires to be very carefully dyed, and always tends the fibre, &c.

To the above modes of developing or production may be added a series of processes by which the shade can be made faster by an after-treatment with certain chemical reagents. In most cases the action is not understood, and may depend upon oxidation or the formation of a lake, &c.

The substances most generally used for this purpose are copper salts, chrome compounds, tannin materials, &c. (See pages 148, 197 and following pages.)

Bleaching powder is used in a few cases, and an interesting example of this kind is the treatment of dyeings produced with Sulphine with bleaching powder, which turns the shade to an orange yellow and also increases the fastness. (See page 199.)
Dyes insoluble in water, or Spirit Colours.

Quinoline Yellow soluble in spirit  Parme soluble in spirit  
Ceroflavine  Induline N soluble in spirit  
Eosine soluble in spirit  Nigrosine G soluble in spirit  
Coralline soluble in spirit  Deep Black N soluble in spirit  
Spirit Blue RR  Japan Black ME G soluble in spirit  
Spirit Blue IV  Japan Black M soluble in spirit  
Spirit Blue III  Japan Black extra soluble in spirit  
Spirit Blue T  Japan Black ST soluble in spirit  
Spirit Blue II  

These products are not used at all for wool or cotton.

Many of them, e.g., *Quinoline Yellow soluble in spirit, Eosine soluble in spirit, Spirit Blue, Induline N soluble in spirit, Nigrosine G soluble in spirit*, and to a less extent *Japan Black*, are used for producing colours on silk that are fast to water.

Method of dissolving: Dissolve in a sufficient quantity of hot spirit by shaking or stirring. Where possible use the solution whilst still warm.

For calico printing dissolve not in spirit but in Acetine. This process has been patented to us.

Dyeing process for silk: No. 1b, page 247 (or No. 4).

**Acetine Blue.**

This product is a solution of a spirit soluble Induline in Acetine. It is not used at all for dyeing cotton, wool, or silk. On the other hand it is consumed on the largest scale for calico printing.
Wool.
Most Important Methods of Dyeing Wool.

These are:

1. Dyeing in an acid bath.

This method of working is used for all acid colours, for many substantive and for a few basic dyes (e.g., Victoria Blue B, 4R, Night Blue, Rhodamine B, G).

2. Dyeing in a neutral bath.

The basic dyes, Alkali Violet, Neutral Blue for Wool, and certain substantive colours are dyed according to this method.

3. Dyeing in an alkaline bath.

This method is used almost exclusively for Alkali Blues, and in certain cases also for Alkali Violets.

4. Dyeing in a slightly acid bath with tartar, alum, and acetic acid.

This process serves specially for the Eosine, Erythrosine, Phloxine, and Rose Bengal brands.

5. Dyeing on a chrome mordant.

This method is generally used when Aniline Colours are dyed in conjunction with Alizarine or wood colours.
6. Dyeing in a chrome bath.

   This process is extensively employed when a simultaneous stripping of coloured shoddy is required. It is also used for dyeing cheap unions which are to be topped in a second bath with wood dyes.

7. Dyeing in an acid bath and then adding metal salts (bichromate of potash, copper sulphate).

   This has a special effect on the shade and fastness of some aniline or substantive dyes.

8. Dyeing in presence of copper sulphate, iron vitriol, &c.

   Generally adopted when working with wood colours.

9. Dyeing in presence of tin salt, chloride of tin, oxalic acid, &c.

   Is mostly used when dyeing with Flavine, Cochineal.

10. Dyeing in a soap bath, then stoving.

   This method is only used for producing a few very delicate shades.

11. Dyeing on a sulphur mordant.

   This is a special process which is used in isolated cases for producing shades with basic greens.

12. Dyeing in presence of sulphurous acid or sulphites.

   Is specially adapted for producing very bright shades. (Scarlets, &c., on Berlin yarn, ball dress materials.)
Woollen Piece-Goods.

Apparatus for Dyeing Pieces.

The most modern arrangement for dyeing piece-goods is a wooden vat, the front of which contains a perforated partition, and this is the one which is almost exclusively used.

The steam pipe is placed behind this partition, and in this manner the pieces are best prevented from coming into direct contact with the metal or with the steam as it enters the vat.

With such an arrangement, it is not necessary to interrupt the dyeing operation when colour solution or mordant requires to be added, as these can be poured in behind the partition.

Some vats are fitted with a wooden case, which completely covers the top of the vat. At the sides of this are hanging doors, and it has also a wooden chimney to conduct the steam outside.

This arrangement has its advantages and its disadvantages, and opinions are divided with regard to its practical value.

With the old forms of apparatus (copper boilers heated with direct fire, vats with open steam pipes) it was frequently necessary to wind up the piece and let the bath cool down whenever anything was added to the vat.

If the vat were not cooled down, creases were liable to result.

In order to avoid this, the acid and colour solution were often diluted down and added with a ladle, but in spite of all precautions uneven dyeings were frequently obtained, especially when dyeing light shades.

As a general rule, the latter method is not to be recommended, although it is a fact that under favourable conditions (namely, for instance, when allowing the reel to run quickly, and with materials and shades that are not so delicate, and otherwise applying practical experience, &c.) good results can be obtained.

The quantity of water required for dyeing depends on the construction of the vat and the quality of the material.
Preparation of Piece-Goods.

As a rule, pieces which have been carefully dressed will only require to be wetted out before dyeing.

If on the other hand, their appearance and smell indicate that the dressing has not been carried out to perfection, they must be washed in a suitable manner. This is effected in several ways, depending on the degree of impurity.

1. If the goods are actually greasy, the best way is to wash them in lukewarm water containing 1—3 lbs. soda per 100 lbs. of goods. It is advisable to add a little ammonia to the second bath.

   The pieces must subsequently be thoroughly rinsed, in order to remove the soap, which is formed by the action of the alkali on the fat. If hard water is used, a little soda should be added to the first rinsing bath, or there is always the danger of lime soaps being formed on the goods.

   If the pieces contain isolated grease spots, they should also be washed in those places by rubbing and kneading with a solution of soap and ammonia, and then thoroughly rinsed.

2. If only traces of grease are present, or small quantities of soap from milling, it is best to wash them in lukewarm water containing $1\frac{1}{2} - 2\frac{1}{2}$ oz. of ammonia per 10 gallons of water.

   In most cases, it will not be necessary to rinse the goods after this treatment, as if a trace of ammonia is left behind in the pieces, it can only be injurious when working with basic dyes, and these are very seldom used for piece-goods.

   The above process is frequently carried out in the dyeing machine itself, and the liquors containing the ammonia are simply run off before preparing the dye-vat.

3. When working with heavy piece-goods, it is often necessary to commence dyeing without acid in order that the dye may penetrate the goods. If such pieces appear to be clean, and only require to be washed as a precautionary measure, the dyeing and cleansing processes can be combined.

For this purpose, \(1\frac{1}{2}\) oz. of ammonia are added for every 10 gallons of neutral dye-liquor, in addition to the necessary amount of Glauber's salt. (Acetate of ammonia may be used in place of ammonia.)

The ammonia not only cleanses the goods, but at the same time helps to produce better penetration. If an excess of ammonia is present, it is driven off into the air by boiling before the acid is added.

4. For the bleaching of wool, see pages 117 and 122.

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General Precautions to be taken when dyeing Piece-Goods.

1. If those dyestuffs are chosen which are very gradually extracted from the dye-liquors, certain qualities of goods can be dyed quite well in very long endless bands. As a rule, however, it is not advisable to stitch too many pieces together.

Recently constructed dyeing machines are so arranged that the pieces do not require to be stitched together in one endless band, but they are allowed to run side by side on the reel. This prevents any parts of the pieces from lying still too long in the liquid.

Pieces with a smooth finish must always run over the reel in the direction in which the fibres lay, so that the coloured strip at the end of the piece always comes first.

When working with round copper boilers, the pieces are always stitched end to end so as to prevent them becoming entangled with each other. Care must however be taken, not to fasten too many pieces together and that the reel runs rather quickly.

2. When possible, the pieces forming the endless band should be opened out a little, so as to avoid constant folding in the same creases.

3. The heat creases which are known to every dyer, can be avoided by taking care that the pieces do not remain at rest for any length of time when sampling, or when interruptions take place in the dyeing process.

With some materials, the dye-liquor must be cooled down sufficiently by running in cold water before the goods are removed from the dyeing machine.
In many dye-houses, the pieces are passed direct from the dyeing machine through a movable rinsing vat. This helps further to prevent the formation of heat creases, and also removes most of the salts, acids, and unfixed dye from the goods.

When working with pieces which are very liable to form creases, they are passed through two rinsing vats, then opened out and rolled tightly and evenly on to wooden rollers.

4. Where possible, each dye-house should have special vats reserved for dyeing shades of a similar nature, and care should be taken not to dye any other shades in these vats.

Where this is not the case, the dyeing machines must be thoroughly boiled out, and, if necessary, also cleansed with acid before using them for dyeing bright shades.

The best method of preparing such a machine for dyeing very delicate shades, is to boil pieces in it that are required for dark colours. A little acid is added to the water in the vat, and this removes the dyestuffs from the wood and fixes them on the pieces in question.

Difficulties encountered when dyeing Piece-Goods.

1. The formation of dark spots or dark resinous blotches on the pieces may be caused by:—

   a) Imperfect dissolving of the dyestuff.

      (A full description of how to avoid this difficulty is given on page 3.)

   b) Using very hard water, i.e., water containing lime.

      As a general rule this can only cause trouble when working with basic dyes, and it is seldom that these are used for piece-goods. This is discussed in dyeing process No. 2, page 99.
c) Working with goods that have not been thoroughly cleansed.

If any soap cards (lime soaps) are present in the pieces, it frequently happens that these boil out and mechanically absorb colour solution, after which they fix themselves on various parts of the goods. This is especially the case when working with acid dyes.

The only possible means of preventing this, is to previously wash the pieces thoroughly with water that contains a little soda. The result, however, is always a doubtful one, as if the lime soaps are once formed in the cloth they are very difficult to remove. This must therefore be avoided in the milling and finishing operations.

d) Unsuitable treatment of certain dyestuffs.

A few acid dyes which are easily soluble in pure water, and which are most extensively used on account of other good properties, cause difficulty when used in a lukewarm acid bath. This is due to the formation of a precipitate of colour acid, which rapidly coagulates and forms coppery flakes which stick to the goods and form spots which are difficult to remove. To avoid this, the dye solution, which should not be too concentrated, is added to the boiling acid dye-bath, or a very dilute solution of the dyestuff is poured into a cooler dye-bath.

In both cases, the precipitated colour acid redissolves immediately in the dye-liquor.

If the goods are dyed in a neutral bath, no such separation of colour acid can take place, but it is precipitated as soon as acid or bisulphate is added. The bath should therefore be brought to the boil before these fixing agents are poured in.

2. Irregular, uneven shades and imperfect penetration.

Unevenness may be caused by the pieces containing different kinds of wool which vary in colour, and in this case the dyer can seldom overcome the difficulty.

If, on the other hand, the trouble is caused by the dyestuffs that have been used, or by the method of dyeing, it can frequently be remedied. See the notes on dyeing process No. 1, page 94 and following pages.

Imperfect penetration, which is closely connected with uneven shades, is also discussed at the same place.
3. Dull shades.

Many colours, especially several of the scarlets, are very sensitive to the action of metallic copper.

If work with copper boilers is unavoidable, or if the presence of copper heating pipes has an unfavourable influence on the clearness of the shade, 3 oz. of ammonium sulphocyanide should be added for every 100 gallons of liquor in the dye-bath. In most cases this will produce a decided improvement.

One should further take note that prolonged dyeing will also dull many bright shades. In such cases, therefore, the dyeing should be finished as quickly as possible.

4. Dark lists.

In most cases these can be traced back to the weaving or the preparing processes.

They may also be caused by the dyeing process, and it is much easier to avoid them when dyeing in a tangled state, than when the goods run in the open width.

In the former method of working, a one-sided heating or cooling is practically excluded, as the pieces continually fold in different places.

When dyeing in a tangled state, the pieces can be opened out with a stick, which helps to produce a more frequent changing of the folds.

Dark lists may be produced by allowing the dyed goods to lie over the horse without being previously rinsed. In this case, the liquor in the goods which contains dyestuff that has not been completely extracted, runs down into the lowest parts.

This can easily be avoided by rinsing the goods or by piling them up flat.

We might also mention here, that lists can also be formed when working with wood colours. In this case, it is generally due to the oxidising action of the air, which is more energetic on those parts of the pieces which are exposed, than on those in the interior.

5. Light lists.

These are met with in pieces which, owing to the way they are woven, are inclined to roll up at the edges. This can be prevented by sewing the lists together and then dyeing.

It is very difficult to obtain satisfactory results with Aniline dyes on heavy goods that have been carbonised. This is especially the case if the goods have been extracted on the drum, and not on the stretching frames or on a drying machine constructed on the same principle. It is very seldom that the dyer can overcome this difficulty, and it has therefore become usual to carbonise the goods after dyeing. No difficulty that is worth mentioning stands in the way, as quite a large number of colours are fast to carbonising (see list on page 505).

Little difficulty is encountered in dyeing light woollen goods (flannel, ladies' dress-goods, &c.) which have been previously carbonised, because goods of this class are well prepared and usually extracted on frames.

7. Mildew.

Up to the present time no remedy has been found for the damage produced by mildew.

One can certainly prevent it from spreading by moistening the wool with a solution of carbolic acid or with spirit, also by rinsing it in boiling water. In most cases, however, the wool is so altered in the parts that have been attacked that its effect cannot be concealed.

8. Undyed burls.

If only a few burls are visible after dyeing, they can be removed in the ordinary manner with the burling iron. They can also be hidden by smearing them with ink (an alcoholic preparation of logwood) if the cloth has been dyed a dark colour.

With some materials, the burls can be hidden to such an extent, that only the larger ones require to be removed mechanically, if when dyeing dyestuffs which impart a slight colour to vegetable fibres in an acid bath are used.

Only a small number of colouring matters, however, will serve the above purpose, viz:—Fast Blue K. Soluble Blue. Acid Violet 4 BN. Alkali Violet. Asoflavine. Rhodamine. Palatine Black 4 B, 6 B. (A special method of working must be used for the latter product.)

In some cases, good results can be obtained by using a small quantity of substantive dyes in conjunction with acid dyes.
When dyeing dark navy blues for example, the burls can be partially hidden by adding a little Oxamine Blue RRR and Cotton Yellow. Grounding Black for Cotton also serves the same purpose.

Our special brand Burl Black can be used for dyeing black shades on goods which only contain a few isolated burls.

Pieces which contain a large number of burls must be carbonised or treated with sumach and iron and then topped with basic colours. Such material can also be dyed in an acid bath and then finished off with suitable substantive dyes in the washing machine, or one may dye them with substantive dyes by the one or two-bath method. (See pages 292—299.)

We will now consider the more important processes that are in use for dyeing woollen piece-goods.

1. Dyeing in an acid bath.

As this is by far the most important method of dyeing piece-goods with Aniline Colours, we give a rather detailed description of it.

This is a quicker and easier style of working than that of using wood colours, and the goods suffer very little by it. The wool also retains its natural feel and gloss, due to the use of acid fixing agents.

If carefully carried out the process is as follows:

The vat is well cleaned out, and enough water is run in to permit of the goods being easily worked in it. (About 25—50 times the weight of the material.)

The bath is now warmed up to about 140 ° F., and the necessary amount of colour dissolved in water is added to the vat through a fine hair-sieve or through a coarse cotton cloth filter. About 15—25 lbs. of crystalline Glauber’s salt (or $\frac{1}{2}$ this quantity of calcined Glauber’s salt) for every 100 lbs. of goods are now thrown in.

The goods which have been well cleansed and wetted out are then entered and the bath is raised to the boil, the reel running quickly the whole time. After boiling for $\frac{1}{4}$ hour, the first lot of bisulphate (acid sodium sulphate) is added. If this is difficult to obtain, ordinary sulphuric acid which has been previously diluted is used. (When diluting it the acid should always be poured slowly into the water, and not the water into the acid.)
In some cases the acid fixing agent can be added in one lot to the dye-bath. As a rule, however, it must be added in 3 or 4 portions with an interval of 1½ hour between each.

For dark shades, up to 12 lbs. of bisulphate or 4 lbs. of sulphuric acid 168º Tw. will be required, and for light shades a correspondingly less amount. (For these in most cases 3—5 lbs. of bisulphate or 1—1½ lbs. of sulphuric acid is sufficient.)

When working with dyeing machines of modern construction, this acid is carefully poured in behind the perforated partition of the vat, so that the dyeing operation is not interrupted. (Of course, the steam must be shut off.)

The same holds good with regard to the addition of colour solution, but if a large amount of acid has already been added, one will frequently find it necessary to cool down somewhat by adding cold water.

With old vats which have no partition, it is necessary to cool down the liquors and to run the pieces up, or to spread them out on the rack.

In most cases, however, in order to avoid the formation of heat crumples, the vat is simply cooled down, and the acid is carefully and slowly stirred in at suitable places.

After the dyeing process is completed the vat is always cooled down by running in cold water, and, if necessary, some of the liquor is let off. The pieces are then rinsed and hydro-extracted.

The time required for dyeing depends upon local conditions and on the quality of the material, and varies from 1½—2½ hours.

Of course, it also depends on how often one has to shade off.

Some materials (e.g., loosely woven cheviots, &c.) must be dyed as quickly as possible, to prevent them shrinking too much or becoming too thin. Thick heavy goods, on the other hand, must be dyed slowly in order to produce penetration.

The previously described dyeing process is subject to a series of alterations, depending upon circumstances.

Of these the following will be more closely considered:—

a) As already mentioned, the amount of water required varies between 25—50 times the weight of the goods.

As a general rule, heavy cloths require about the minimum stated, whereas lighter materials are dyed in more dilute solutions.

The amount of fixing agent required, depends to a certain extent on the dilution of the vat liquors. If large quantities of water are used, the amount of Glauber’s salt and bisulphate added must therefore be considerably increased above the amounts stated.
b) Sometimes it is advisable to enter the goods in a lukewarm bath, and sometimes in a boiling bath. This depends on the nature of the material and on whether the colours used dye evenly or not. As a rule the pieces may be entered without danger into a boiling bath if it only contains Glauber's salt and no bisulphate or acid.

c) A preliminary boiling in a neutral bath is a great help towards producing level shades, and is indispensable when dyeing materials which are difficult to penetrate.

If the goods are very difficult to dye through, better results may be obtained by using more Glauber's salt.

If these precautions do not suffice, add 10 to 16 gills of acetate of ammonia B. A. S. F. per 100 gallons of dye-liquor, in addition to the usual quantity of Glauber's salt. This should be added at the commencement of the dyeing process, which is then proceeded with in the ordinary manner.

d) Adding the acid fixing agents at intervals has the effect of causing the dyestuff to be taken up slowly by the fibre, and thus tends to produce level dyeings.

One must therefore pay full attention to this precaution, in addition to using an increased quantity of Glauber's salt and adding acetate of ammonia. In difficult cases, the most reliable way of obtaining good results is to add smaller quantities of bisulphate at a time, and to increase the interval between each addition.

e) Bisulphate as also acetic acid do not act so powerfully as free sulphuric acid, and when working with them there is not the same danger of spoiling the dyeings by adding them too often or in too large quantities.

f) In some cases, clearer and more level dyeings can be obtained, by first boiling the goods in a bath containing 1—4 lbs. of sulphuric acid 168⁰ Tw. for every 100 lbs. of goods. After boiling for 3/4 hour in this solution, they are dyed in a fresh bath.

As a rule, it is not necessary to add any acid to the dye-bath, but only a solution of the colour and the Glauber's salt. (Of course, if too little acid has been added when boiling on, and the colour is not taken up by the fibre to a sufficient extent, a suitable amount must be added to the dye-bath.)
g) When dyeing light delicate shades, such as pinks, &c., it is often found very difficult to produce the shade sufficiently clear. This may be due to the use of boilers or steam pipes of copper, also to the vat, water, or goods not being sufficiently clean. If, however, none of these are at fault, the next thing to suspect would be the quality of the bisulphate (the amount of nitric acid it contains).

The quickest method of getting over this difficulty is to use sulphuric acid and Glauber's salt in place of the bisulphate.

With regard to the dulling action of metallic copper and the prevention of it by means of ammonium sulphocyanide, see page 92.

h) When working with goods which tend to dye unevenly, or when dyeing delicate shades in an old liquor, the latter should be carefully neutralised by adding soda or, better still, ammonia. (The most rational method is to neutralise most of the acid with soda, and the remainder with ammonia.)

The latter should be added until the bath after having been stirred up is slightly alkaline, i.e., just smells of ammonia.

A slight excess is not injurious, as it is driven into the air on boiling.

With some materials and dyestuffs, however, one can work in an old bath straight away without any trouble at all.

This is especially the case when the bath contains a very large quantity of Glauber's salt, due to repeated additions for each dyeing, as it tends to prevent the too rapid action of the acid.

On the other hand, however, there is a series of Aniline Colours which are indispensable on account of their low price and other good properties, with which the above-mentioned precautions must be taken.

Requisite additions when working with old liquors.

The second and following baths generally require about $\frac{1}{4}$ of the amount of Glauber's salt and bisulphate originally added. If the liquors have been in use for some length of time, a still less quantity will suffice.

When working with liquors which have been neutralised, one must of course add as much bisulphate as was added in the first case, but only $\frac{1}{4}$ of the original amount of Glauber's salt will be required.
Correction of goods which are streaky, uneven, or too dark.

If a piece has come up even but a little too dark, it is a frequent practice to put another piece in the vat and to boil again. This has the effect of causing part of the colour to leave the dyed piece and to go on to the undyed one. This method is only of use, however, if the piece in question has been dyed with level dyeing colours.

Blotchy dyeings can be sufficiently improved in many cases, by boiling for 1/2 hour in the old dye-liquor to which a large quantity of Glauber's salt has been added. Another method is to let part of the liquor run off and to fill up with fresh water. This is often useful for correcting shades which have become too dark.

Dyeings which have been produced with colours which require little acid in the dye-bath, and which become lighter if boiled in a strongly acidified bath (e.g., Wool Green S) can be corrected by letting them run for some time in a fresh boiling bath to which some bisulphate has been added.

If none of these methods produce the desired effect, the goods must be stripped as far as possible by boiling in a fresh bath containing 3—10 lbs. of acetate of ammonia B.A.S.F. for every 100 lbs. of goods.

The material can then be dyed in the same bath by putting in Glauber's salt and adding acid very slowly.

Appendix to dyeing process 1.

Although the brands Victoria Blue B, 4 R, and Night Blue belong to the group of basic dyes, still they require to be dyed in a bath which has been strongly acidified. (10—15 lbs. of bisulphate and also Glauber's salt per 100 lbs. of goods.)

On the other hand, Victoria Blue R is dyed with 15—25 lbs. of Glauber's salt and only very little bisulphate (1—2 lbs.).

If necessary or desirable the latter brand can be dyed without any acid whatever. When working with goods that are liable to dye unevenly, however, the best results are obtained by the first method.

The Rhodamine brands which are used for wool, and which are also basic colours, (G, B, 3 B, G extra, B extra, 3 B extra) are best dyed with 15—25 lbs.
crystallised Glauber's salt and 1—3 lbs. of bisulphate for 100 lbs. of goods. The exact amount of these substances required depends on the depth of the shade. (Some qualities of wool require still more acid.)

The Rhodamine brands were formerly dyed by the method that is in use for the Eosines (see No. 4).

These colours must not be dyed in copper boilers. If, however, it is quite impossible to avoid using them, ammonium sulphocyanide must be added to the bath to counteract the injurious influence of the copper (see page 92).

**Substantive colours** are generally dyed by boiling for ½ hour with 5—25 lbs. of crystallised Glauber's salt, and then slowly adding acetic acid until the bath is sufficiently exhausted. With several products, e.g., *Thiazine Red*, it is also necessary to add a little bisulphate.

On the other hand, very little acid must be used when working with *Cotton Yellow G, GI, GR, Carbazol Yellow*, and *Salmon Red*, or the shades would become dull. With *Cotton Red 4 B* and *4 B extra* acid is only added when hard water is used.

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2. Dyeing in a neutral bath.

Only a few of the **basic colours** are used for wool, for producing special shades. In addition to those already mentioned, viz.:—the *Victoria Blues* and Rhodamines which are dyed in an acid bath, only the following are of any importance:— *Diamond Magenta, Methyl Violet, Crystal Violet, Auramine*, and at times *Diamond Green* (or *Victoria Green* or *Brilliant Green*).

These products are easily affected by hard water and form precipitates in it. Such water must therefore be corrected before use. The easiest way of doing this is to add ½—1½ pints of acetic acid 9° Tw. to every 100 gallons of water. Of course, the exact amount required depends on the degree of hardness.

A slight excess of acid is no disadvantage in this case, as it causes the colour to exhaust more slowly. If, on the other hand, too much acid is added, the baths exhaust badly and the shades obtained are not so beautiful. This is especially the case with Diamond Magenta.
In many dye-houses, the water used for preparing the first vat for basic colours is previously boiled with bran. 1/2 lb. of bran is added to every 100 gallons of water which is then boiled for 5—10 minutes. The dirty scum is then removed, and the Glauber’s salt and colour solution, and finally acetic acid are added and the dyeing is commenced.

Detailed description of dyeing process 2.

The well cleansed goods (free from grease) are entered into the hot dye-liquor, to which has been previously added 10 lbs. of Glauber’s salt for 100 lbs. of goods, and the dyeing is continued for 3/4 hour at the boil.

(Auramine is an exception, and when working with this product the temperature must not rise above 160—165° F.)

The dyestuffs are dissolved in distilled water, or in water that has been previously corrected with acetic acid as above described. This solution is then added to the bath through a coarse flannel or cotton filter.

If goods that have been dyed with basic colours have come up too dark, they can easily be corrected by adding a little more acetic acid to the vat.

Bronzy spots that have been produced by careless working with hard water, can be removed by stripping the goods as well as possible by boiling in water to which some bisulphate has been added. After this the goods are rinsed and then re-dyed.

Appendix.

Alkali Violet, Neutral Blue for Wool, and Burl Black belong to the group of acid dyes, but they are dyed in a similar manner to the basic dyes.

These colours are, however, in no way sensitive to hard water, and therefore the goods can be entered into a dye-bath to which only Glauber’s salt has been added, in which they are boiled for 3/4 hour. If the bath is not sufficiently exhausted after this time, a trace of acetic acid is added and the dyeing continued for another 1/4 hour. (With Burl Black boil for 1/2 hour in a neutral bath, and then add a sufficient quantity of bisulphate.)

Notes.

The mistake that is most frequently made when working with Alkali Violet and Neutral Blue, is that of adding acetic acid at the beginning of the dyeing process. These colours dye extremely even shades in a neutral bath, but acid causes them to be too rapidly absorbed by the wool, so that if the above mistake has been made, the dye will penetrate the goods badly and the colour will rub off.
Of course the same difficulty will be encountered if the pieces themselves contain acid, which is often the case with shoddy for example. This can be counteracted by previously washing the goods with water containing a little ammonia.

As these colours are very fast, it is almost impossible to correct dyeings which have been spoilt in this manner, and therefore full attention should be paid to the above precautions.

If desired, Alkali Violet can be dyed by the process which is used for Alkali Blues, which is described below.

The above method of working can also be used for dyeing substantive dyes in a neutral bath. These colours have recently been extensively used in this manner.

The following are specially adapted for this purpose:

Carbazol Yellow. Pyramine Yellow G. Pyramine Orange 3G, RR.

3. Dyeing in an alkaline bath.

The various Alkali Blue brands are dyed by this method. The colours of this group exhaust well and dye evenly in a slightly alkaline bath, and they can then be developed to their full strength by brightening in a bath containing acid.

If dyed directly in an acid bath, a large quantity of colour acid would be precipitated, as it is difficultly soluble.

The dyeings obtained in this manner would therefore be irregular, of bad penetration, and the colour would rub off.

At present one of the following alkalies is generally used for adding to the bath:

1. 2—3 lbs. borax
2. 1/2—1 lb. calcined soda
3. 5 lbs. of sodium silicate — per 100 lbs. of goods.

Good results can also be obtained by using ammonia in place of the above.

The clearest shades are obtained with sodium silicate, and the next best in this respect is borax, which gives very similar shades. Soda is the one that is most generally used, and it gives somewhat duller shades.
The method of dyeing is as follows:

The goods are entered into the hot dye-bath to which one of the above-mentioned substances has been added. For light shades they are boiled for $\frac{1}{4}-1\frac{1}{2}$ hour, and for dark shades 1 hour.

They are then well rinsed, and afterwards brightened in a fresh hot bath ($160^\circ$ F.) containing 1—4 lbs. of sulphuric acid, or 3—12 lbs. of bisulphate, per 100 lbs. of goods, for $\frac{1}{4}$ hour.

As the goods come from the dye-bath they are of a pale greenish grey colour, and in the brightening bath this is changed to the full blue which is peculiar to these products.

Finally the goods must be thoroughly rinsed.

Notes.

a) Copper vessels have a very injurious action on the shade of the Alkali Blues, and they must therefore be avoided as far as possible when working with these colours.

b) An excess of alkali not only injures the goods and produces crumples, but it also dulls the shade.

If when dyeing light shades the boiling is continued too long, the same injurious effect is to be expected.

c) When working with Alkali Blue the shade is sampled by brightening a small cutting of the piece in an acid bath. It cannot be done otherwise except by a very experienced dyer.

d) It is absolutely necessary to thoroughly rinse the goods after dyeing and brightening, in order to make them as fast to rubbing as possible.

e) When dyeing light shades on pieces that have been tightly milled, it is advisable to work at $140-160^\circ$ F.

f) As the baths are far from being exhausted, a considerable saving of dyestuff is effected by dyeing dark shades in old liquors.

Clearer shades are also obtained when working with old liquors than is the case with a freshly prepared bath.

Where possible, therefore dark shades are first dyed in new liquors and then sky blues are dyed in the same bath.

g) The Alkali Blues cannot be dyed in conjunction with other colours (with the exception of the Alkali Violets), so that if they require to be shaded off, this must be carried out in the brightening bath. Of course, only those colours which give very level shades can be used for this purpose.
Piece-Goods. Dyeing in a slightly acid bath.

For shading towards green, one can use:—

*Wool Green S* (or a little *Bluish Green S*) and also *Fast Yellow G*.

For redder shades:—

*Sorbine Red, Azocarmine G, Rhodamine B,* and *Acid Violet* can be used.

h) If Alkali Blues have lost too much in beauty and strength in the milling process, the original shade can generally be restored by rinsing in an acid bath.

The Alkali Blues have been replaced to a great extent by our *Victoria Blues*, as the latter are cheaper, brighter, and faster to milling. They cannot, however, take their place in all cases, as the Victoria Blues are not so fast to light as the former.

Goods which require to be both as fast to light and to milling as possible, should be grounded with Alkali Blue and then topped in the brightening bath with Victoria Blue.

The latter and also *Acid Violet 3 BN and 6 BN* are extensively used for deepening light shades that have been produced with Alkali Blue.

4. Dyeing in a slightly acid bath containing tartar, alum, and acetic acid.

This process is almost exclusively used for dyeing with the *colours of the Eosine group*.

It is seldom used for the Rhodamines, as these give quite as beautiful shades when dyed with Glauber's salt and a trace of bisulphate.

The following is the most suitable method of working:—

In addition to the requisite amount of colour solution, add to the lukewarm dye-bath:—

2 lbs. tartar
2 » alum
1—2 lbs. acetic acid 9° Tw.

per 100 lbs. of goods. Enter the well-cleansed goods which have been previously wetted out, and raise slowly to the boil. Boil for 1/2 hour and then rinse.
Notes.

a) If uneven shades are obtained, it will in most cases be due to heating up the liquor too rapidly.

b) An unpleasant sticky feel of the goods can be caused by the action of alum in the dye-liquor on any soap which has been left in the pieces.

c) Additions of sulphuric acid or bisulphate are injurious. They make the shades duller and prevent the colours being utilised to their full extent.

d) Where possible the Eosines are replaced by the Rhodamines which are faster to light.

If, however, one cannot dispense with the Eosines, because of their fuller overhand appearance and fastness to milling being desired, and one wishes to have a colour which is also faster to light, they can be used in conjunction with the Rhodamines.

In such cases the above-described dyeing process is used, but the other colours are only added after the Eosines have been completely (or almost completely) extracted.

If acid is required in order to produce the desired shade, a little acetic acid can be added which causes the dyestuff to be better utilised.

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5. Dyeing on a chrome mordant.

This method is seldom used for dyeing Aniline Colours alone, but it serves for dyeing Aniline Colours in conjunction with Alizarine or wood colours.


We might, however, mention here that for medium shades the wool is boiled 1 1/2 hours with

3 lbs. of bichromate of potash or bichromate of soda
2 1/2 » » tartar or
2 1/2 » » lactic acid

and then thoroughly rinsed.
For dyeing, the requisite quantity of acetic acid is added, and for Aniline Colours which do not exhaust well, a little bisulphate or sulphuric acid is also added towards the end, and the work is in other respects effected as described under dyeing process No. 1.

Notes.

a) If the pieces cannot be dyed immediately after mordanting, they must be well rinsed, then hydro-extracted and piled up level. One must avoid hanging them over the horse.

b) For cheaper working, the amount of tartar mentioned above is often replaced by 1 lb. of sulphuric acid 168° Tw.

The action of the latter is, however, rather different from that of tartar, as it liberates the chromic acid, after which chromium chromate is formed, whereas when tartar or lactic acid is used chromium oxide is formed.

This difference is an important one when working with Alizarine Colours, as several of them give faster and more beautiful shades on chromium oxide.

c) On a chrome mordant, the following Aniline Colours give faster dyeings, or different shades as compared with those produced in the ordinary manner:

- **Wool Green S** (fuller and faster to washing)
- **Acid Violet 4 BN** (bluer and covers better)
- **Acid Violet 4 R** (yellower and faster to washing)
- **Fast Scarlet B** (browner and faster to washing)
- **Fast Red AV** (browner and faster to washing)
- **Fast Yellow** (greener, duller, and faster to washing)
- **Azoflavine** (greener, duller, and faster to washing)
- **Eosine** (duller, fuller, and faster to washing)
- **Cotton Yellow R** (very much faster and fuller).

The so-called chroming colours, that is, colours that are dyed in an acid bath and subsequently treated in the same liquor with a bichromate, can, of course, also be dyed on a chrome mordant. The following dyes belong to this group:—the **Mordant Yellows**, **Fast Mordant Yellow G**, **Palatine Chrome Brown A, W**, **Palatine Chrome Red R**, **Palatine Chrome Violet**, and the **Palatine Chrome Blacks**.

**Dark Green in paste** might also be mentioned in connection with the above list; it gives fast brown shades on a chrome mordant.
6. Dyeing in the chrome liquor.

This method is frequently made use of when the ground colour of shoddy is to be partially stripped and at the same time the goods require to be dyed a brighter shade.

In most cases about 3 lbs. of bichromate of potash (or bichromate of soda) are used for 100 lbs. of goods, and sulphuric acid is added in place of tartar.

The colour solution is only added to the bath after the goods have been treated for some time with the chrome.

The following colours are frequently used for this purpose:—

for navy blues:— *Soluble Blue HA, SV, and 3376,*

» claret:— *Acid Magenta S, Wool Scarlet RR,*

» Russian green:— *Light Green SF yellow and blue shade.*

The following will withstand a weak chrome bath:—


Also *Cotton Yellow R* (substantive). *Mordant Yellow G, GR, and R. Fast Mordant Yellow G.* (The latter are mordant colours, but they can also for a few purposes be dyed in an acid bath and used with acid dyes.)

A great change in shade is produced with:—

*Fast Red AV* (it yields a dark maroon).

For details of the above method of working, see under shoddy, page 127.
7. Dyeing in an acid bath with a subsequent addition of metal salts.

A few Aniline Colours are rendered much darker or are changed in shade, and also in some cases become much faster, if after being dyed in the ordinary manner they are boiled for \(\frac{1}{2}\) hour with 1—1\(\frac{1}{2}\) lbs. of bichromate of potash (for 100 lbs. of goods) in the dye-bath.

These are:

1. *Fast Red AV*  
2. *Fast Red E*  
3. *Naphthol Red S*  
4. *Naphthylamine Red BBB*

which give full claret shades.

These are:

1. *Cotton Yellow G, GI* (give yellows of good covering power)  
2. *Cotton Yellow R* (gives a full-bodied old gold shade)  
3. *Oxamine Red*  
4. *Oxamine Claret M*  
5. *Oxamine Garnet M*  
6. *Oxamine Maroon*

all give full claret shades.

When working with *Mordant Yellow G, GR, R, Fast Mordant Yellow G, Palatine Chrome Red R, Palatine Chrome Violet, Palatine Chrome Blacks*, and *Palatine Chrome Browns*, this after-treatment with bichromate is very important, and indeed indispensable, for producing the maximum fastness and fulness of shade.

The dyeing is effected according to the general principles of the first method (see page 94) and as soon as the dye-bath is sufficiently exhausted, the solution of potassium bichromate is added and the boiling continued for half an hour longer. (When dyeing with Palatine Chrome Brown continue the treatment with bichromate for \(\frac{3}{4}\) to 1 hour.)

This treatment brings out the correct shade and makes the dyeings very much fuller, and increases the fastness to an extraordinary degree.

Notes.

The correct development depends upon the quantity of the chrome added, if too little is used the dyeings will not be so fast.
If, on the other hand, too much is taken, there is the danger of part of the colour being attacked, i.e., partially or entirely destroyed.

The following dyes are only slightly affected by after-chroming, and they can therefore be used for shading the above colours and others when dyed according to process 7:


The dyeings produced with certain products can be rendered much darker and faster by adding copper sulphate to the bath at the end of the dyeing operation.

The most important of these are the Thiazine Reds, especially the brand R. Copper sulphate turns the shade of these colours towards claret, and renders them extremely fast to light.

8. Dyeing in the presence of copper sulphate, iron vitriol, &c.

This special process is used when wood colours are dyed in conjunction with certain Aniline Colours which are adapted for this purpose.

The following are extensively used in this manner:


These products are used to brighten the shade of the wood colours, or to render them faster to acids.
For 100 lbs. of goods add to the dye-bath:—

\[2 \frac{1}{2} \text{ lbs. of green vitriol}\]
\[1 \frac{1}{4} \text{ » } \text{blue vitriol}\]
\[2 \frac{1}{2} \text{ » } \text{oxalic acid}\]

together with the solutions of logwood extract and of the Aniline dyes, and boil for \(\frac{1}{2}\) hour.

Now gradually add bisulphate, of which 5—10 lbs. are necessary for shades that are required to be moderately fast to acids, and 15 lbs. for very fast shades. Finally rinse well.

The whole time required for dyeing is \(1\frac{1}{2}—2\) hours.

If the goods do not require to be fast to acids, it is not necessary to add any bisulphate, or only a very small quantity.

\textit{Note.}

When using Alkali Violet in combination with wood colours the metal salts and oxalic acid should not be added until the goods have been boiled for \(\frac{1}{2}—\frac{3}{4}\) hours in a neutral bath.

\[\text{---}\]

9. Dyeing in presence of tin crystals, chloride of tin, oxalic acid, &c.

This method is only used when cochineal is dyed in conjunction with certain Aniline Colours. (It is of no special interest when dyeing with Aniline Colours alone, although a few dyers believe that it gives better results than the ordinary methods of working.)

The following Aniline Colours are used together with cochineal:—

\textit{Orange II. Palatine Scarlet A, RRR. Scarlet R, RRR, also Phloxine and Rhodamine.}

The last two colours (or groups of colours) are used for brightening the shade of the cochineal, whereas the others are used for the sake of cheapness.
The liquors used for dyeing with cochineal are generally prepared with

\[
\begin{align*}
2 \text{ lbs. oxalic acid} \\
1\frac{1}{2} \text{ » tin crystals} \\
1\frac{1}{2} \text{ » tartar} \\
1 \text{ lb. chloride of tin — for 100 lbs. of goods.}
\end{align*}
\]

The powdered cochineal, which has been previously allowed to soak in a solution containing a little tin crystals is now added and the goods are then dyed for 1 hour at the boil.

Dirty water should first be boiled up with bran.

In all cases the goods must be thoroughly rinsed in soft water, as this increases the beauty of the shade.

Orange, Palatine Scarlet, Scarlet (and where necessary also Rhodamine) are frequently added to the same bath after the cochineal has been absorbed. It is however advisable, even in this case, to brighten in a fresh bath.

The latter method must always be used when dyeing with the Phloxine or Eosine colours.

Cocliineal has recently been replaced in many cases by the Palatine Scarlets, which are cheaper, faster to light, and easier to work with.

If necessary they can be brightened (rendered bluer) by adding a little Rhodamine.

### 10. Dyeing in a soap bath and then stoving.

This method is only used for producing very light delicate shades.

In order to obtain good results, it is of primary importance that only such colours must be used as are sufficiently fast to stoving.

The following have been proved by practical use to be suitable:

The goods are dyed in a lukewarm soap bath which contains a little soda. They are then hydro-extracted, not too much but evenly, after which they are immediately stoved and then rinsed. Such shades as will withstand it are rinsed lukewarm. The stoving takes place in air-tight wooden chambers; in large establishments however, rooms built of masonry are used.

In all cases a sufficient quantity of roll sulphur is placed in a shallow iron pan or in a block of stone that has been chiselled out, it is then ignited, and the chamber is closed as tightly as possible. Of course, the sulphur only burns as long as the air present in the room will permit, and forms sulphurous acid gas with the oxygen of the air. When all the oxygen is used up, it goes out.

Notes.

a) The amount of soap required depends upon the hardness of the water, a sufficient quantity has been added when the liquid commences to froth distinctly. On an average 3/4 oz. of soap will be required for every gallon of water.

If the water is very hard or also contains iron, it is advisable to correct it before adding the soap by boiling it with the requisite amount of soda.

b) A considerable amount of experience is required in dyeing to shade, as no Aniline Colour is perfectly fast to stoving.

When working with very light shades there is always the danger of stoving too severely and thus rendering the shade too light, or of stoving too cautiously and thus not getting the shade sufficiently clear.

When working in bulk, the shade is often sampled by hanging a small piece of the goods in a large bottle at the bottom of which is a mixture of sodium bisulphite and sulphuric acid, which, of course, gives rise to sulphurous acid gas.
11. Dyeing on a sulphur mordant.

As already mentioned this is a special process for green shades and is seldom used. It is described here for the sake of completeness. The goods are worked for $\frac{3}{4}$—1 hour in a warm bath (120—140 ° F.) which contains

- 12 lbs. sodium thiosulphate (hyposulphite)
- 6 » alum
- 3 » sulphuric acid 168 ° Tw.—for 100 lbs. of goods.

When working according to this process no metal must be present. It is therefore carried out in a wooden vat which is heated with a rubber tube fixed on to a steam pipe.

After mordanting, the goods are rinsed, and then dyed at the boil in a fresh bath with a basic green. The shades produced in this manner are very bright, but the wool suffers considerably.

12. Dyeing in the presence of sulphurous acid or sulphites.

This method was discovered by us and a patent has been applied for. By this process, the delicate shades which were formerly produced by stoving finished dyeings, can be obtained in one bath. In this case no difficulty is encountered in shading off, whereas great experience is required when working according to the old process, as the shade loses so much in strength when stoved.
Example:

To produce a delicate pink shade on 100 lbs. of wool, prepare the bath with

300 gallons of water
5 lbs. sodium bisulphite 70° Tw.
3½ oz. Rhodamine B or G
10 lbs. Glauber's salt
2 » sulphuric acid 168° Tw.

enter the goods, raise to the boil and dye to shade.

Note.

The colours used for the above process must, of course, be fast to sulphurous acid, in the same way as those used for the old process. Full shades can also be produced by this method, e. g., bright red with Palatine Scarlet, fiery yellow with Tartrazine, clear violet with Acid Violet 4 BN, &c. if such shades are wanted.
List of the most important Aniline Colours that are used for dyeing woollen piece-goods.

In addition to others the following are used on the largest scale:

Woollen Yarn Dyeing.

Woollen yarn and woollen piece dyeing both depend upon the same principles, and the methods of working which have just been fully described are used for both. It does not, therefore, appear necessary to describe these processes again in full.

1. Apparatus for dyeing woollen yarn.

At the present time yarn is generally dyed in wooden vats, but machines are also extensively used. The copper boilers which were formerly employed for this purpose have been almost entirely given up, which is a step that can only be approved.

The wooden dye-vats are heated with a steam-coil, which lies under a perforated false bottom of wood. In some cases, the pipe is fitted behind a perforated wooden partition which stands 4—6 inches from the top end of the vat and which is a little lower than the latter.

This partition offers the same advantages as a modern dye-vat for piece-goods, as solutions of dyestuff and mordant can be poured into the space behind it without danger during the dyeing process. When working with delicate shades and wool, however, it is advisable to first lift out the yarn.

Two kinds of dyeing machines are employed, viz:—those in which the hanks are turned by mechanical means instead of by manual labour, and those in which the yarn, after being packed in them, remains stationary, whilst the dye-liquor is forced through it.
Woollen Yarn. Preparation for dyeing.

It is not necessary to give a description of the first of these two, as the principle is the same as when working by hand. With regard to the latter, we might mention that they have proved to be very satisfactory for dyeing woollen yarn wherever they have been introduced. They are used for producing staple shades of brown, Russian green, navy blue, black, &c., on Berlin wool and knitting yarn.

It is important that the water used for dyeing should be as soft as possible, and Glauber's salt, or better still acetate of ammonia, should be added to the bath. The yarn requires to be re-arranged once during the dyeing process, and the colour solution and acid fixing agents are added at intervals in several portions.

We might also mention another method of dyeing woollen yarn. When working according to this process no special machine is required. The yarn is laid in a perforated box, or fixed in some manner above the surface of the dye-liquor, and then dyed in the foam which is caused to froth up from the liquors. (See Dyeing of cheeses, page 226).

2. Preparation of the yarn for dyeing.

Washing of the yarn.

a) Yarn which is liable to curl or felt together, e.g., weft and fine worsted yarns, is scalded before washing or dyeing. This is done by laying them in bundles for 1—2 hours (or frequently overnight) in boiling hot water.

b) If the yarn contains oil, it must as a rule be thoroughly cleansed. It is only dyed in the grease in very few cases (e.g., certain kinds of carpet yarn) but even this is not advisable as it may easily give rise to uneven dyeings, and as a rule the colour is far from being fast to rubbing.

Yarn is cleansed in a very similar manner to piece-goods, by washing in lukewarm water which contains from 1—3 lbs. of calcined soda for every 100 lbs. of yarn. The exact amount of soda required depends upon the quantity of grease present in the goods. Carded woollen yarn, for example, must be thoroughly washed but it is very seldom that worsted yarn requires a severe washing.

In addition to soda, a little soft soap is also frequently added.
c) For finer yarns, e. g., Berlin yarn, which is dyed in a soap bath and then stoved (see process 10, page 110), the cleansing and dyeing process are generally combined. It would be found extremely difficult, and in many cases impossible, to produce level shades on yarn which had been previously stoved.

**Bleaching of yarn previous to dyeing.**

As sodium peroxide can now be obtained at a moderate price, it is used in several cases for bleaching (especially for porcelain white, Victoria white, &c.). Yarn that has been treated with this substance can be dyed level shades without any difficulty.

The method of bleaching is as follows:—

13 lbs. of sulphuric acid 168° Tw. are slowly stirred into 100 gallons of water. A little ice should then be added, and 10 lbs. of sodium peroxide added in several portions to the solution.

If stronger bleaching liquors are required, the above quantities may be doubled, or trebled, that is, as much as 39 lbs. of sulphuric acid and 30 lbs. of sodium peroxide may be added to 100 gallons of water.

The solution obtained in this manner should have a neutral reaction, if not, add a trace more acid, and before use it must be made slightly alkaline by adding ammonia. (The tests can be made with litmus paper.)

The well-cleansed yarn is entered into the cold bath, which is then warmed up as slowly as possible to 120° F, after which the yarn is left standing for several hours or better overnight immersed in the liquid.

If this has not bleached it sufficiently, a fresh liquor is prepared and the yarn is again entered. Finally it is well washed, and if a crisp handle is desired, it is worked in a cold bath to which a little sulphuric acid has been added.

As a rule, the bleaching liquors can be used several times without any fresh additions being made. If they do not work sufficiently well more acid and peroxide must be added.

**Treatment of woollen yarn with alkalies.**

This process is mentioned here for the sake of completeness. It greatly increases the affinity of the yarn for colouring matters, so that it is quite easy to produce two-colour effects on pieces which contain ordinary woollen yarn and yarn which has been prepared in this manner.
Woollen Yarn. Precautions when dyeing.

The process is as follows:

The yarn which has been previously wetted out, is worked for \( \frac{1}{2} \) hour at the ordinary temperature in a solution of

\[
50 \text{ lbs. caustic soda } 72-76^\circ \text{ Tw. and } \\
45 \text{ » grape sugar in } \\
90 \text{ gallons of water,}
\]

after which it is well rinsed.

The wool becomes somewhat yellower, but does not lose in strength to any appreciable extent.

It is chiefly the acid and substantive dyes which are used for producing two-colour effects in the above manner.

3. General precautions to be taken when dyeing.

a) Yarn which has just been washed and rinsed can be dyed at once, whereas clean dry yarn must always be wetted out before being dyed.

b) When dyeing yarn it must be very carefully turned, especially those qualities which easily felt. It should not be turned any more than is necessary.

c) The steam must never be allowed to come into direct contact with the yarn, and if the vats have been properly constructed this can never take place.

d) Too much acid makes the wool brittle, and this fact must always be borne in mind when working with old liquors to which acid fixing agents have been continually added.

e) After dyeing, the yarn must be cooled down, which is done by opening it out on the sticks and letting it hang in the air for some time. It is then washed, hydro-extracted, and dried.
Suitable method of dyeing woollen yarn.

When the yarn is dyed on sticks, about 350 gallons of water are required for every 100 lbs. of yarn, but if the yarn is dyed by immersing it under the surface of the liquid, about 160 gallons are required. (This method is described later.)

The methods used for dyeing woollen yarn are practically the same as those which serve for dyeing piece-goods. For this reason only the most important of them are considered here, i.e., the dyeing with acid dyes.

The description of the mechanical details can be considered as representative of those for the other methods.

If possible the yarn is entered into the hot acid dye-liquor, and it is generally dyed for $1\frac{1}{2}$—2 hours at the boil.

The difficulties encountered with regard to obtaining level dyeings are in most cases the same as those which are met with in piece dyeing. They must therefore be overcome in the same manner by adding the solutions of dyestuff and fixing agents in several portions at intervals, and if necessary by entering the goods lukewarm, &c.

When working with dye-vats which are fitted with a steam pipe that is placed under a perforated false bottom, the yarn is always dyed on sticks, and about 3—$3\frac{1}{2}$ lbs. are placed on each.

For a 100 lbs. lot four men are generally employed in turning at the beginning, but later on only two are required. As previously mentioned the yarn must not be turned more often than is necessary. From time to time the sticks must be re-arranged, i.e., those in the middle must be moved to the ends, and so on.

If dye-vats which are fitted with partitions at their ends are used, the yarn is generally immersed beneath the surface of the liquid. A loop of string is passed through the yarn and then hung on to the rods. The length of this string must be so arranged that the whole of the yarn lies beneath the surface of the liquid.

During the dyeing process, the yarn should be re-arranged three times in the strings, and the outside bundles of yarn on a stick should be moved to the centre. The position of the sticks should also be changed as described above.

The first two of these operations take place above the surface of the liquid, and one should make use of this opportunity and add any necessary acid or colour solution to the bath. At other times these solutions can be poured in behind the partition.
The amount of acid required is about the same as is used for piece-dyeing. For acid dyes, 5—12 lbs. of bisulphate (1½—4 lbs. sulphuric acid), according to the depth of shade, are added for every 100 lbs. of yarn.

When dyeing woollen yarn, it is usual to add a very large quantity of Glauber's salt to the first bath, and as much as 50 lbs. of crystallised Glauber's salt (or half this quantity of calcined Glauber's salt) is often added.

The addition of such large quantities is without doubt a great help towards producing level dyeings.

When working with old liquors, only 5 lbs. of Glauber's salt and 1½ lbs. of bisulphate require to be added.

As a rule these liquors are not used for longer than a week, there are, however, exceptional cases where they are used for several months, and others where they are changed before the end of the week.

The demands which are made with regard to the fastness of shades produced with Aniline dyes on woollen yarn are very varied. For some purposes they require to be fast to washing and for others fast to light and water.

As a rule the shades on woollen yarn are not perfectly level at the commencement of the dyeing process. On the other hand, however, the colour should distribute itself evenly after being boiled for some time. The dyeings should be perfectly level ¼ hour after colour solution has been added to the bath.

The following Aniline Colours are used on the largest scale for dyeing woollen yarn:—

Loose Wool.

With the exception of a few products, the Aniline Colours are not used in large quantities for dyeing loose wool.

As a rule they are not sufficiently fast to milling, or there is some other drawback connected with them, e.g., they do not dye the tips of the wool sufficiently.

They are more extensively used for brightening the wood colours than as self-colours.

1. Preparation of loose wool for dyeing.

The quantity of soda used for cleansing loose wool, as also the quantity of ammonia frequently used in addition, depend altogether on the quality and origin of the wool.

In most cases foreign wools (e.g., Sidney and Cape wool) have already passed through one washing process. In such cases only 3—4 lbs. of soda will be required for 100 lbs. of wool, whereas for greasy wools as much as 10 lbs. of soda must be frequently used.

The mechanical arrangements, of course, also play a very important part in wool scouring.

In all cases the wool is scoured for at least $\frac{1}{4}-\frac{1}{2}$ hour at a temperature which should not fall below $105^0$ F. It is then squeezed out and washed, if possible in running water, after which it is ready for dyeing.

In many cases the wool is first sorted, carbonised in the grease, rinsed, burled, and then scoured in the soda liquors.
2. Dyeing of loose wool.

On an average 300 gallons of water are required for every 100 lbs. of wool. It is generally dyed in large round copper boilers and worked with a bent two-pronged fork. A mechanical arrangement has recently been introduced for the latter purpose.

Another method is to use a large copper boiler, which is fitted with a perforated plate that is fixed at a certain distance from the bottom and sides of the boiler. The wool is kept in motion by a paddle which dips below the surface of the liquid.

Loose wool is generally entered into a cold dye-liquor, which is brought to the boil and kept at the boil for $3/4$ of an hour. If a further quantity of dyestuff requires to be added, a very dilute solution is made up and put into the dye-vat with a shallow ladle, and the wool is kept in motion to distribute it as evenly as possible.

After the dyeing is complete, the wool is thrown out and allowed to cool down, it is then rinsed, hydro-extracted, and dried. In large works, this is carried out by placing the wool on hurdles, through which warm air is sucked or blown by means of a fan.

For the dyeing of loose wool in machines, see page 124 on the treatment of slubbing.

Amongst other Aniline Colours the following are preferably used for dyeing loose wool:

- Tartrazine. Thiazine Red R. Acid Violet 3BN, 6BN, 7B, 4R.
- Alkali Violet. Victoria Blue B, 4R. Light Green SF yellow shade.
- Bluish Green S. Wool Green S.


To obtain as clear and beautiful a white as possible on loose wool, it must be specially sorted, great care being taken to avoid yellow tips.

The best results are obtained by working in two baths, and this is also the most reliable method. One can, however, work in one bath if the colours which are mentioned on the following page are used, and the necessary amount of care is taken, and if the standard aimed at is not too high.
Bleaching bath.

Work the wool which has been well scoured and carefully rinsed in the following solution with a wooden rade.

The solution is prepared from

- 10 gallons sodium bisulphite 73 — 78° Tw. (B.A.S.F.)
- 6 pints sulphuric acid 168° Tw.
- 1250 gallons of pure cold water which is free from iron.

The wool remains in this bath for 3 — 4 hours, or frequently overnight, after which it is thrown out and allowed to drain well.

Tinting bath.

After being prepared as above described, the wool is worked for 1/4 hour at a temperature of 104° F., in a bath which contains

- 1 oz. of Alkali Violet 6 B (or 1 oz. of Acid Violet 6 BN, according to shade) dissolved in
- 1600 gallons water which is free from iron.

If a sufficient quantity of pure water is at hand, it is then rinsed and dried at the ordinary temperature.

Notes.

a) Before use the colour is dissolved in 6 gallons of water and added through a woollen cloth to the tinting bath.

b) If pure water that is free from iron cannot be obtained, the water which is used must be boiled up with bran, skimmed and allowed to cool before being employed for the above purpose.

c) The above Aniline dyes give the most beautiful white shades it is possible to produce. They are, however, neither fast to light or milling.

If the white requires to be fast in this respect, the Alizarine Colours must be used, but they are not so clear in shade.
Slubbing.

As a rule slubbing is quite clean when it comes into the dye-house, so that it does not require to be washed. If in exceptional cases it is found necessary to wash it, proceed in the same manner as when washing a fine woollen yarn.

Methods of dyeing.

As the methods used are practically the same as those for loose wool, it is not necessary to describe them again.

Apparatus for dyeing slubbing.

On account of its tendency to felt, slubbing is now extensively dyed in the form of tops or balls in dyeing machines, and the dyeing process is practically the same as that for woollen yarn (see page 115).

It is very important that soft water be used for dyeing, and the colour should be boiled on in a neutral bath and then fixed by gradual additions of acid.

As a rule slubbing does not require to be dyed exceedingly level, but still if the tops are tightly wound only those colours should be used, which are slowly absorbed by the wool, in order to produce sufficient penetration.
Slubbing.

If the apparatus is constructed properly, so that it can be heated up and acid fixing agents can be added as desired, cheaper colours which do not penetrate so well, or dye so evenly, may be used, e.g., *Naphthol Red S, Bluish Green S*, &c.

Unreeled slubbing can be dyed like woollen yarn in the hank in vats, but it requires to be very carefully moved. The liquors must not be allowed to boil up, as this would increase the danger of felting.

In addition to this the same precautions must be taken as when working with delicate woollen yarn.

When choosing the dyestuffs, one must take into consideration for what purpose the slubbing is intended. If it is required for ladies' dress goods, it will not as a rule need to be specially fast to milling. In this case all Aniline Colours could be used which withstand a slight milling. For example, the following colours which also dye level shades could be used:


If, on the other hand, the slubbing is intended for gentlemen's dress-goods, &c., products which are faster to milling must be used (see page 501).

In this case they are frequently used simply for brightening the Alizarine Colours, &c.
Shoddy.

The dyeing of shoddy practically depends upon the same principles as the dyeing of loose wool.

In the shoddy industry, however, one has generally to work with dark-coloured rags which require to be stripped before dyeing.

This makes the work very difficult, as there can be no fixed rules, for although the rags are sorted, they always vary in composition.

For this reason the method of working is somewhat different in each case.

The Aniline dyes are very extensively used for loose shoddy, generally for brightening the Alizarine or wood colours.

The most important conditions are cheapness, fastness to milling and against bleeding into white. Very few colours are sufficiently fast in the latter respect, especially if they must not bleed into either white cotton, wool, or silk. A great many colours are sufficiently fast to milling, but if the goods are allowed to stand for some time in the wet state, they will tend to bleed into the white contained in one or other of the materials above referred to.
1.-Preparation of Shoddy.

As a rule the rags are first sorted with regard to quality and shade, and then carbonised, for which purpose hydrochloric acid gas is generally used.

After this they must be well rinsed in water to remove the acid and carbonised matter.

For this purpose a very complete apparatus and a large quantity of water is required. In most cases, however, these two cannot be had and therefore most of the shoddy as it comes into the dye-house is not perfectly free from acid. This is of no consequence if the goods require to be stripped before dyeing, but full attention must be paid to it if they must be dyed directly, or if dyestuffs are used which are sensitive to acids. For example, Alkali Violet which is very extensively used for shoddy, is extracted too rapidly from an acid bath, and the dyeings obtained in this manner rub off badly. On the other hand, the basic colours, such as Methyl Violet, Crystal Violet, &c., do not exhaust sufficiently if the bath contains acid.

It is therefore advisable to wash such goods with a little soda or ammonia and to rinse them, before dyeing with any colours except the ordinary acid dyes.

2. Stripping of Shoddy.

Light-coloured rags are expensive, and it is seldom that they can be obtained in sufficient quantity. The shoddy dyer therefore often finds it necessary to strip a dark-coloured material as well as possible, so that it can be dyed a bright shade.

It is, however, by no means possible to strip the colour in every case, and it is therefore always necessary to make a small trial to see what is the real state of affairs.
Shoddy. Stripping.

The most important methods of stripping are:

a) Boiling with bichromate of potash and sulphuric acid, with or without an addition of oxalic acid.

This process is naturally liked the best, as the quality of the wool does not suffer very much, and when working with Alizarine or wood colours the mordanting and stripping process can frequently be combined.

For 100 lbs. of shoddy, about 3 lbs. of potassium or sodium bichromate and an equal quantity of sulphuric acid (168° Twaddell) are required.

In several cases, still better results are obtained if 2 lbs. of oxalic acid are also added.

After boiling for 1—1½ hours, the shoddy is washed by placing it in baskets and letting water run over it.

If the rags only lose little of their colour in a chrome liquor of medium strength, one may try if increasing the quantity of stripping agents used will produce better results.

In such cases the goods are frequently subjected to a preliminary boiling, using for 100 lbs. shoddy, up to 12 lbs. of bichromate of potash and as much or even more sulphuric acid (168° Twaddell); the treatment with this liquor is made as short as possible, usually not more than 1/4 hour. Then if it is necessary the usual treatment with 2—3 lbs. bichromate of potash, &c. follows.

These strong chrome liquors are kept, and after being strengthened as required they are used for a few other lots.

It is quite plain that such a treatment cannot improve the quality of the goods, but in many cases the shoddy dyer has no other choice.

b) Stripping with alkalies.

Good results can be obtained with many kinds of shoddy by treating it with 2—2½ lbs. of calcined soda for ½—1 hour (for 100 lbs. of goods).

The rags are worked in this solution at a temperature of 95—104° F., they should not be left in the liquid any longer than is necessary, so as to avoid injuring them.

If they are not stripped sufficiently, it is however more advisable to leave them a little longer in the liquid than to raise the temperature.
c) Stripping with nitric acid.

This method is only adopted when the others fail to produce the desired effect, or when the yellow or yellowish brown shade which is imparted to the wool by this treatment is desired. (This yellow is due to the formation of picric acid.)

This is sometimes the case when olive or brown shades are required, as a saving of the yellow dyestuff for subsequent shading off is thus effected.

It is difficult to give any definite information with regard to the quantity of nitric acid which must be used, as the shoddy varies to such a great extent.

More acid than is required to produce the desired effect should not be used, so as to spare the goods as much as possible and because this acid is expensive.

A small trial must be previously made, to see if the desired effect can be obtained without using so much acid that the goods suffer seriously.

Of course, when working according to this process copper boilers must not be employed.

Many colours can be stripped by soaking the goods for a considerable time in a cold solution of nitric acid with the addition of bichromate of potash, &c., e.g., 2 1/2 pounds of concentrated nitric acid, 4 ounces bichromate of potash, and 4 ounces of concentrated sulphuric acid (168° Tw.) for five gallons of water are used in the first bath. When working in an old bath only the quantity lost in the previous operation requires to be replaced so that on an average one-tenth of the quantities of nitric acid, bichromate of potash, and sulphuric acid have to be added for each operation.

d) Stripping with sodium hydrosulphite.

In several cases very good results can be obtained by this method. For details of the process, see page 287.

e) Stripping by treatment with persulphates (for instance, ammonium persulphate, &c.).

This process has not yet been worked on a practical scale, as the reagents in question are too difficult to obtain. The wool is soaked in a 10% solution in water.
3. Dyeing of Shoddy.

The following methods are used for this purpose:—

a) Dyeing in a neutral bath.

(Used for basic colours, e.g., Diamond Magenta, Methyl Violet, Crystal Violet, New Blue S, Diamond Green, Victoria Blue R, &c., also for Alkali Violet.)

b) Dyeing in an acid bath.

(Used for all acid Aniline Colours, also for Victoria Blue B and 4R which are dyed like these.)

c) Dyeing in the chrome-liquor.

(Used when working with Alizarine and wood colours.)

The method of working and the quantity of mordants used, &c. are the same as when working with piece-goods. In this case, however, on account of the cheapness of the material, one must always try to avoid using large quantities of Glauber's salt and the expensive tartar should be replaced by sulphuric acid, &c.

In most cases the rinsing after dyeing is also omitted.

In addition to others the following Aniline Colours are preferably used for shoddy:—

Pattern-Sheets.

Wool.
Wool.
Dyed in an **acid** bath with acid dyes.
*(Process No. 1.)*

<table>
<thead>
<tr>
<th>Wool</th>
<th>Yellow</th>
<th>Orange</th>
<th>Scarlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinoline Yellow</td>
<td>Orange N.</td>
<td>Palatine Scarlet A.</td>
<td></td>
</tr>
<tr>
<td>Naphthol Yellow S.</td>
<td>Azoflavine II.</td>
<td>Scarlet R.</td>
<td></td>
</tr>
<tr>
<td>Naphthol Yellow S.O.</td>
<td>Orange G.</td>
<td>Wool Scarlet R.</td>
<td></td>
</tr>
<tr>
<td>Tartrazine</td>
<td>Orange G.R.</td>
<td>Scarlet R.R.</td>
<td></td>
</tr>
<tr>
<td>Fast Yellow extra.</td>
<td>Orange II.</td>
<td>Wood Scarlet R.R.</td>
<td></td>
</tr>
<tr>
<td>Fast Yellow G.</td>
<td>Orange X.</td>
<td>Wood Scarlet R.R.R.</td>
<td></td>
</tr>
<tr>
<td>Brilliant Yellow S.</td>
<td>Orange R.</td>
<td>Scarlet R.R.R.F.</td>
<td></td>
</tr>
<tr>
<td>Fast Yellow Y.</td>
<td>Scarlet G.</td>
<td>Scarlet R.R.R.</td>
<td></td>
</tr>
<tr>
<td>Fast Yellow</td>
<td>Wool Scarlet G.</td>
<td>Wood Scarlet R.R.R.R.</td>
<td></td>
</tr>
<tr>
<td>Azoflavine FF.</td>
<td>Silk Red N.</td>
<td>Cochineal Red A.</td>
<td></td>
</tr>
<tr>
<td>Azoflavine RS.</td>
<td>Cotton Scarlet.</td>
<td>Palatine Scarlet RRR.</td>
<td></td>
</tr>
<tr>
<td>Metanil Yellow.</td>
<td>Erythrine R.R.</td>
<td>Palatine Scarlet RRRR.</td>
<td></td>
</tr>
</tbody>
</table>
## Wool.

Dyed in an **acid** bath with acid dyes.

*(Process No 1.)*

<table>
<thead>
<tr>
<th>Fast Scarlet B.</th>
<th>Mars Red G.</th>
<th>Red Violet 5 R.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast Scarlet GGN.</td>
<td>Naphthol Red S.</td>
<td>Red Violet 4 R.S.</td>
</tr>
<tr>
<td>Fast Scarlet G.</td>
<td>Palatine Red A.</td>
<td>Red Violet 4 R S N.</td>
</tr>
<tr>
<td>Crystal Scarlet.</td>
<td>Naphthylamine Red BBB.</td>
<td>Palatine Chrome Violet. <em>(Process 7.)</em></td>
</tr>
<tr>
<td>Erythrine X.</td>
<td>Fast Red B.</td>
<td>Acid Violet 3 BN.</td>
</tr>
<tr>
<td>Erythrine P.</td>
<td>Naphthylamine Brown.</td>
<td>Acid Violet 4 BN.</td>
</tr>
<tr>
<td>Scarlet 6 R.</td>
<td>Azocarmine G.</td>
<td>Acid Violet 6 BN.</td>
</tr>
<tr>
<td>Sorbine Red.</td>
<td>Azocarmine BX.</td>
<td>Acid Violet 7 B.</td>
</tr>
<tr>
<td>Sorbine Red BB.</td>
<td>Acid Magenta S.</td>
<td>Soluble Blue T R.</td>
</tr>
<tr>
<td>Fast Red AV.</td>
<td>Acid Magenta ST.</td>
<td>Soluble Blue H A.</td>
</tr>
<tr>
<td>Fast Red E.</td>
<td>Acid Magenta S III.</td>
<td>Soluble Blue T B.</td>
</tr>
<tr>
<td>Palatine Chrome Red R. <em>(Process 5.)</em></td>
<td>Acid Violet 4 R.</td>
<td>Soluble Blue 3376.</td>
</tr>
</tbody>
</table>
Wool.
Dyed in an acid bath with acid dyes.

*Process No. 1.*

<table>
<thead>
<tr>
<th>Soluble Blue S.V.</th>
<th>Neptune Green S.B.</th>
<th>Brilliant Black BBB.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soluble Blue H.B.</td>
<td>Neptune Green S.</td>
<td>Brilliant Black B.</td>
</tr>
<tr>
<td>Pure Blue I.</td>
<td>Wool Green S.</td>
<td>Brilliant Black M.</td>
</tr>
<tr>
<td>Pure Blue II.</td>
<td>Bluish Green S.</td>
<td>Blue Black B.</td>
</tr>
<tr>
<td>Soluble Blue I.N.</td>
<td>Light Green S.F.</td>
<td>Palatine Black 6 BN.</td>
</tr>
<tr>
<td></td>
<td>blue shade.</td>
<td></td>
</tr>
<tr>
<td>Wool Blue R.</td>
<td>Acid Green G.B.</td>
<td>Palatine Black 5 BN.</td>
</tr>
<tr>
<td>Wool Blue S.S.N.</td>
<td>Light Green S.F.</td>
<td>Palatine Black 4 B.</td>
</tr>
<tr>
<td></td>
<td>yellow shade.</td>
<td></td>
</tr>
<tr>
<td>Wool Blue S.N.L.</td>
<td>Light Green S.</td>
<td>Palatine Black B.</td>
</tr>
<tr>
<td>Wool Blue S.L.</td>
<td>Nigrosine W.</td>
<td>Palatine Chrome Black 3 B.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Process 7.)</td>
</tr>
<tr>
<td>Indigo Carmine D.</td>
<td>Fast Blue S.B.</td>
<td>Palatine Chrome Black A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Process 7.)</td>
</tr>
<tr>
<td>Indigotine II.</td>
<td>Fast Blue R.</td>
<td>Methan Black 3 BN.</td>
</tr>
<tr>
<td>Wool Marine Blue BN.</td>
<td>Methan Dark Blue R.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Methan Black E.</td>
</tr>
</tbody>
</table>
Wool.

Dyed in an **acid** bath with basic dyes of a certain nature.

(\textit{Process No 1.})

<table>
<thead>
<tr>
<th>Victoria Blue 4 R.</th>
<th>Victoria Blue B.</th>
<th>Night Blue.</th>
</tr>
</thead>
</table>

Wool.

Dyed in a **neutral** bath with basic and certain acid dyes.

(\textit{Process No 2.})

<table>
<thead>
<tr>
<th>Auramine II.</th>
<th>Methyl Violet R R R R R.</th>
<th>Alkali Violet R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magenta Powder A.</td>
<td>Methyl Violet B.B.</td>
<td>Alkali Violet 4 B.</td>
</tr>
<tr>
<td>Diamond Magenta I small needles.</td>
<td>Crystal Violet.</td>
<td>Alkali Violet 6 B.</td>
</tr>
<tr>
<td>Cerise D IV.</td>
<td>Diamond Green G.</td>
<td>Victoria Blue R.</td>
</tr>
</tbody>
</table>

Wool.

Dyed in an **alkaline** bath with acid dyes of a certain nature.

(\textit{Process No 3.})

<table>
<thead>
<tr>
<th>Alkali Blue 5 R.</th>
<th>Alkali Blue B extra.</th>
<th>Alkali Blue 5 B.</th>
</tr>
</thead>
</table>

Wool.

Dyed in a **slightly acid** bath with dyes of the Eosine and Rhodamine groups.

(\textit{Process No 4.})

<table>
<thead>
<tr>
<th>Eosine A.</th>
<th>Erythrosine I N.</th>
<th>Phloxine BBN.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eosine M.L.</td>
<td>Phloxine H.</td>
<td>Rose Bengal NT.</td>
</tr>
<tr>
<td>Eosine B N.</td>
<td>Phloxine G N.</td>
<td>Rhodamine B.</td>
</tr>
</tbody>
</table>

Sheet 4.
Dyeing Cotton Yarn.

Apparatus for dyeing yarn.

1. Wooden vats are generally used for dyeing cotton in the hank and they are usually constructed to hold 50 or 100 lbs. It is seldom that they are made larger or smaller than this.

During the dyeing process the hanks are hung on smooth rods, so that only about $\frac{1}{4}$ of their length is above the surface of the dye-liquor. The yarn is turned by hand, or a stick may be used. (In the latter case a pointed stick, which is thinner than that on which the yarn hangs, is passed through the hank, below the other stick, and the yarn is then raised with it and turned.)

For several purposes, e.g., for Aniline Black, the yarn is dyed in machines. The arrangement is practically the same as that of an ordinary dye-vat, but the yarn is turned by machine instead of by hand.

The vats must be so constructed that the yarn can be easily turned without too much water being required in proportion to the cotton.

The following are suitable internal dimensions:

For 50 lbs. of yarn.

Length . . . . . . 64 inches.
Breadth . . . . . 22$\frac{1}{2}$ »
Depth . . . . . 23$\frac{1}{2}$ »

For 100 lbs. of yarn.

Length . . . . . 118 inches.
Breadth . . . . . 22$\frac{1}{2}$ »
Depth . . . . . 23$\frac{1}{2}$ »
The liquors are heated by a steam-coil which can be placed in the liquid at the top end of the vat.

If the vats are long, two coils can be used, but if short one is sufficient.

These coils are closed at the ends but the sides are suitably perforated with holes. It is best to fix them on to the steam pipe by means of a bayonet coupling, so that they can be removed from the liquid when desired.

In order to prevent the liquid from becoming too diluted or from flowing over, due to the introduction of water from the steam pipes, it is advisable to fix a special valve in the main pipe, just before the place where the pipe which enters the vat is fitted on. If this valve is always left open a little, the greater part of the water which is carried over with the steam will be able to escape.

A plug is fixed in the bottom of the vat which can be knocked out when the liquor requires to be run off. Another arrangement is to have a valve which can be opened by turning a handle or drawing a plug from the outside. In order to protect the workmen from getting scalded, however, the above arrangements have recently been replaced by taps.

The rods on which the yarn is placed should be hard and straight sticks of hazel, ash, &c. The knots should be burnt out or removed in such a manner that no rough places are left.

For special purposes, for instance, when working with the sulphur dyes, such as Kryogene Black B and others, iron pipes bent four times at right angles are used instead of rods. When using these it is possible to keep the yarn under the surface of the dye-liquor. This method is in particular adopted when very level shades are required.

Many sulphur dyes, for instance, Kryogene Black G, Kryogene Brown and others can, however, be dyed on the ordinary rods.

2. The method of dyeing in machines has of late been more and more extensively used for cotton yarn, and without doubt it will become very important in the future.

In this case the yarn may be dyed in the form of cops, bobbins, &c., which are tightly packed into a chamber, or placed on spindles of vulcanite, metal, &c., which are fixed on to a suction disc.

The principle is the same in all cases. The cops remain stationary and are dyed by forcing or sucking the liquor through them, or the motion of the liquid is alternate.

It would be out of place here to give a description of the various systems that are used.
3. A third method is that in which the warp dyeing machine is used. For practical reasons this is described later, on page 218 and following pages.

4. The arrangements for dyeing in the size are also described later, on page 229.

Preparation of cotton yarn for dyeing.

Boiling out.

The cotton yarn, which is bound together in \( \frac{1}{2} \) or \( \frac{1}{2} - 1 \)-lb. lots, must first be cleansed by boiling out. A wrought iron boiler capable of withstanding pressure is used for this purpose and the yarn is looped together in chains of 2, 5 or 10 lbs. before being placed in it. In some districts they are loosely twisted together in 1-lb. lots.

In the absence of a proper boiling-out apparatus a large open wooden vat is used. As a rule, the only drawback connected with the use of such a vat is that a larger amount of steam is required.

Yarn which only contains the average amount of impurity simply requires to be boiled for several hours in water. Care must be taken that the whole of the yarn remains below the surface of the liquid.

If the yarn does not appear clean enough a little calcined soda may be added (1\(^{0}/_{o}\) on the weight of the cotton), but in most cases this is not necessary.

A disadvantage connected with the addition of soda is that the yarn must then be thoroughly rinsed for many purposes (e.g., for all mordant dyes). If no soda has been added, it is generally sufficient to run off the liquid from the yarn, fill up again with water and again run off.

After boiling off, the yarn should always be hydro-extracted or wrung out well, and then mordanted or dyed as soon as possible so that a partial drying or rotting of the yarn cannot take place.
Cotton Yarn. Bleaching.

**Bleaching Yarn.**

If bright shades are required the yarn must be bleached before it is dyed.

In this place, only those methods are mentioned which are of interest to the dyer who has to bleach small quantities himself. Descriptions of the methods used in large works (bleaching in cisterns or kiers with injectors, bleaching by electricity, &c.) appear to be superfluous here, especially as the yarn is frequently not so regularly bleached that it can be used for all branches of dyeing.

The bleaching powder is prepared by first mixing it to a smooth thick paste with a little water, to which more water is then gradually added. This can be best carried out in a small wet grinding mill, but where this cannot be had, a wooden tub or an earthenware or metal vessel can be used.

After dilution, the mixture is allowed to stand for some time and the clear liquid is then carefully removed by a ladle from the sediment, or it can be run off through taps which are fixed at various heights above the bottom of the settling tub.

The sediment is again treated with a further quantity of water, and the solution obtained is used together with fresh solution for the next lot of yarn.

When working with small lots, one requires about $2\frac{1}{4} - 4$ lbs. of bleaching powder for 100 lbs. of boiled-off yarn, and under favourable conditions of working a still smaller quantity can be used.

The solution obtained in this manner is diluted in wooden vats by adding water up to 165 gallons.

The yarn is turned a few times in this liquid and then immersed in it overnight. Egyptian cotton or twine must be turned oftener during the bleaching process.

If one bleaching proves to be insufficient, the whole process (including the souring and the rinsing, which are described below) must be repeated in the same manner.

After leaving the bleaching liquor, the yarn is always allowed to drain a little and then soured by turning 5—6 times in a fresh cold solution of 9—10 lbs. sulphuric acid 168° Tw. in 180—200 gallons of water. Finally it must be thoroughly rinsed.

The next step is the treatment of the goods in an antichlor bath in order to remove the last traces of chlorine which always remain behind in the cotton. In some dye-houses this step is usually omitted, but the omission results in a subsequent tendering of the yarn.
For this purpose 1 lb. of antichlor (sodium thiosulphate, sodium hyposulphite) is dissolved in 180—200 gallons of water, the yarn is turned half a dozen times in this solution and then well washed.

If the above-described bleaching process is effected in large cement tanks, the cotton is made up into two-pound lots and packed into them and left overnight. In the morning the liquor is run off and the yarn re-arranged and the process repeated.

In this case, a smaller quantity of bleaching powder is required than when working in wooden vats, as the solutions used are more concentrated.

We might mention here that in order to keep the yarn as soft as possible, it is advisable to convert the bleaching powder into hypochlorite of soda by adding soda to it.

This can be carried out in quite a simple manner by adding a solution of soda to one of bleaching powder, until a sample of clear liquid, which has been filtered off from the precipitate, will not give a precipitate with either a solution of soda or of bleaching powder.

On an average 1 lb. of calcined soda is required for 10 lbs. of good bleaching powder.

The solution of hypochlorite of soda prepared in this manner is used for bleaching in exactly the same way as a solution of bleaching powder.
General precautions to be taken when dyeing and drying cotton yarn.

1. As already mentioned on page 135, the yarn should be used as soon as possible after being boiled out, as streaky dyeings can easily be caused by a partial drying.

   If it is not possible to dye the yarn immediately, it ought to be protected as well as possible from the action of the air and light by covering it with a wet cloth.

   There can be no objection, if it has to be kept for a short time, to pouring a little water over it at intervals, but care must be taken not to let it lie until the cotton begins to smell.

   If necessary, small lots of yarn which have been boiled out can be kept for a few days by placing them in a vat and leaving them covered with water.

2. Yarn as it comes from the spinning mill sometimes appears streaky, due to the different kinds of cotton being badly mixed. It is very seldom that perfect results can be obtained on such yarn, especially when working on a mordant.

   A decided improvement can often be brought about, however, by passing the yarn after it has been boiled out, through a weak acid bath (containing $1 - 1\frac{1}{4}$ pints of sulphuric acid $168^\circ$ Tw. or 3 pints of hydrochloric acid $32^\circ$ Tw. per 100 gallons of water) after which it is well rinsed.

   This method is especially suitable for crochet yarn, knitting yarn, and lower counts of mule yarn which afterwards require to be mordanted. Care must of course be taken not to make the bath too strongly acid.

3. When dyeing light delicate shades it is not advisable to place more than two pounds of yarn on each rod, as it would then be found difficult to obtain level shades. For medium and dark shades three pounds are frequently placed on one rod and in exceptional cases (e.g., for Aniline Black) even four pounds. In such cases the best results are obtained by turning the yarn with a stick and not by hand.

   For a 100-lb. lot of yarn 4 workmen for turning it are always required at the beginning, but the number can be reduced to two when the dyeing is fairly advanced. At the commencement the yarn must be turned quickly, but towards the end, more time can be taken.
4. The yarn is dried on rods which are hung in the air or in a drying chamber, or on large frames that are shaped like a reel. These frames are placed in a heated room and are caused to rotate rapidly by a machine.

The continuous drying machines have been extensively adopted in large works. They are fitted with fans and the yarn is dried in about one hour.

The most beautiful shades are in many cases obtained if the yarn is dried in the open air. In this case it must, of course, be protected from rain and soot, and from the direct rays of the sun.

This method has, for obvious reasons, been extensively replaced by the introduction of drying chambers or drying machines. It should be noticed that better results are obtained with good ventilation and a comparatively low temperature (104—122° F.) than when a high temperature is used and the air is not changed so often.

In every case injurious gases (acid, chlorine, &c.) and exposure to light must of course be avoided, and care must be taken that everything is kept sufficiently clean.

At the present time too little attention is paid to these details, but especially when laying down new drying plant too great economy of space leads subsequently to frequent damage to the goods.
Most important methods of dyeing cotton.

Unmordanted cotton.

This is dyed in the following ways:

1. In hot or cold liquors with addition of Glauber's salt, common salt, alkalies, sodium sulphide, &c.
   (This is used for the substantive and sulphur dyes, &c.)

2. By topping cotton which has been grounded with substantive or sulphur dyes with the basic dyes.
   (This is used for all basic Aniline dyes.)
   Grounding with cachou and topping with basic dyes falls under this class.

3. With an addition of alum or aluminium sulphate to the liquors.
   (Used for Victoria Blue B, 4 R, Indoine Blue, and also for producing very light shades with other basic colours.)

4. With an addition of stannate of soda and sulphuric acid to the dye-liquor.
   (For very bright shades with Soluble Blue.)

5. In a concentrated lukewarm (or cold) bath containing common salt.
   (For Eosine, Phloxine, and Rose Bengal.)
6. In a concentrated lukewarm (or cold) bath containing common salt and alum.

(For Cotton Scarlet, Erythrine RR, P, X, Quinoline Yellow, Azoflavine, Orange X. Also for Scarlet, Fast Scarlet, Tartrazine, &c., but these are not so important.)

7. In a lukewarm bath slightly acidified with acetic acid.

(For Rhodamine S and for Rhodamine 6 G in very light shades.)

8. In the size.

(For substantive dyes, also for light shades with acid dyes, e.g., Azoflavine, Orange X, Erythrine, Cotton Scarlet, Nigrosine, Soluble Blue.)

Mordanted cotton.

This is dyed in the following ways:—

1. Dyeing on a tannic acid-antimony mordant or on a mordant of tannic acid and iron.

(For the various basic dyes, also for Soluble Blue, Dark Green in paste, and so on.)

2. By topping a ground produced with cutch and metal salts with basic Aniline Colours.

(For all basic colours, but especially Diamond Magenta, Saffranine, Vesuvine, Cerise, Auramine, &c.)

3. By grounding with substantive dyes in the presence of some tannin substance and topping with basic dyes (with or without an antimony passage).

(For all substantive and basic dyes.)
Cotton Yarn. Most important methods of dyeing.

4. Dyeing on a mordant of tannin and alumina acetate.
   (Rhodamine S, &c.)

5. Dyeing on a mordant of sodium stannate and basic alum.
   (For producing very full bright shades with Cotton Scarlet, Erythrine RR, &c.)

6. Dyeing on a mordant of soap and stannic chloride.
   (For bright shades with Methylene Blue and Soluble Blue.)

7. Dyeing on a mordant of Turkey-red oil or of Turkey-red oil and acetate of alumina.
   (Leaving the Alizarine Colours out of consideration, this method is applicable to Rhodamine B, G, 6 G, Auramine, &c.)

Production of colours on the fibre itself.

Production of Nitrosamine Red, Aniline Black, &c., also the development of the substantive dyes on the fibre.

The treatment of certain shades with metal salts, chlorine, &c., in order to increase their fastness might also be mentioned here.
Detailed description of the various methods of dyeing.

Dyeing unmordanted cotton yarn.

1. Dyeing in hot or cold liquors with the addition of Glauber's salt, common salt, alkalies, alkaline sulphides, &c.

As already mentioned this method is chiefly used for the substantive dyes and the following are the most important ways of working:—

a) Boil for 1 hour with an addition of 5—20 lbs. Glauber's salt (or common salt) per 100 lbs. of yarn. The exact amount required depends on the depth of shade and the nature of the dyestuff used.

The following can be dyed in this manner:—

The following colours give fuller and more beautiful shades if common salt is used instead of Glauber's salt:—


b) Dye as in No. 1a, but also add 1—5 lbs. of calcined soda or potash per 100 lbs. of yarn.


The goods should be slightly rinsed after dyeing.

c) Dye with an addition of 5—20 lbs. Glauber’s salt or common salt and 3 lbs. of Marseilles soap.

This is used for *Cotton Yellow GI, Oxamine Blue G, B, BG,* (in light shades), *Oxamine Green MN* and *Oxamine Dark Green MN.*

It is also advisable to adopt this process for the other substantive dyes when they are used for light shades which are difficult to dye level.

d) Work as described under c but also add 1—3 lbs. sodium phosphate.

This method serves for *Cotton Yellow G* and also for producing very bright shades with *Patent Cotton Yellow GI, GR, GRR,* and light shades with *Oxamine Green MN.*

e) Dye with an addition of 5—20 lbs. of Glauber’s salt or common salt, 2 lbs. of soap and 4 lbs. of soda or potash for every 100 lbs. of yarn.

*Salmom Red, Cotton Red 4B, 4B extra, Cosmos Red, Cosmos Red extra,* are dyed in this manner.

f) Dye with the sole addition of 100 lbs. of salt to every 200 gallons of water. (This gives a liquor standing at 6° Tw.)

Used for dyeing dark shades with *Cotton Orange G* and *R.*

g) For every 100 lbs. of yarn add 2—3 1/2 lbs. of acid potassium oxalate to the water that has to be used for dyeing, then add the colour solution, Glauber’s salt, &c.

The amount of acid potassium oxalate required depends upon the hardness of the water.

Amongst other uses, this method serves for producing very green shades with *Cotton Yellow G* and *GI.*
Cotton Yarn. Dyeing without mordant with substantive dyestuffs.

The exact quantity of acid potassium oxalate required depends upon local conditions and should be accurately determined by experiment, as an excess is injurious. (It causes the colour to exhaust badly and gives rise to dull shades.)

h) Dyeing cold. The dyestuff is mixed with its own weight of caustic soda 78° Tw. and then dissolved by adding a sufficient quantity of hot water. The solution obtained in this manner is added to the cold dye-bath, along with a little soap, and the dyeing is then commenced.

In addition to others the following dyestuffs are specially adapted for this method of working:


i) Dyeing with an addition of alkaline sulphides, which is only suitable for certain colours. (Fast Black, Anthraquinone Black, Kryogene colours.) It is described on page 150.

k) Dyeing in caustic alkaline baths (Cotton Red S) is described on page 156.

We wish to distinctly point out, that the description of the use of our substantive dyes according to the seven processes first given above (a to g), is only intended to inform the dyer that

the fullest development of shade of the respective dyes is obtained when they are dyed according to these recipes.

One must not, however, consider for a moment that the products in question will not give satisfactory results if dyed according to the simplest method of working (1a).

The following are perhaps the only exceptions in this respect:

- Cotton Yellow G (for full, well-developed yellow shades) and Cotton Orange G and R (for very full shades).
Description of the methods of dyeing with the 
substantive dyes.

When dyeing light shades on 100 lbs. of cotton yarn, use 200 gallons of 
water, and for dark shades 130 gallons.

For dark and not too delicate shades the yarn is generally entered at the boil, 
especially if only one colour is used.

The dyestuff and the necessary fixing agent are added in one lot. The boiling 
is continued for \( \frac{3}{4} \)—1 hour, after which the yarn is rinsed slightly, hydro-extracted 
or wrung out well and dried.

If any difficulty is encountered with the above method of working, the dyeing 
must be commenced at a lower temperature (120—140° F.), the bath being afterwards raised to the boil. Another alternative is to add the Glauber's salt or common salt in portions at a time to the hot liquor during the dyeing process. If necessary both these precautions can be combined.

If soap, soda, or potash is used, they must be added to the water in which the 
goods have to be dyed before any of the other substances. If the water requires to be boiled with alkalies, the soap is added after this has taken place.

If very hard water is used, some soap curds will nevertheless be formed (lime soap), and these must be skimmed off before the cotton is entered.

Cotton which has been dyed dark shades should always be lightly rinsed, 
as should also dyeings which have been produced in the presence of soda. Salmon 
Red and Cotton Red 4B (method 1 e) are, however, exceptions, as in these cases it is advisable to leave a little soda in the yarn to increase the fastness of the shades to air.

No Glauber's salt or common salt is added at first to the weak lukewarm baths intended for light delicate shades, but the prescribed amount of soap or sodium phosphate should be added.

The hydro-extracted yarn is then entered and turned quickly for \( \frac{1}{4} \) hour, 
after which the bath is slowly warmed to 140° F. If the colour does not exhaust sufficiently, a little Glauber's salt or common salt may now be thrown in, or the temperature of the bath can be raised.

Yarn which has been dyed a light shade is not generally rinsed unless alkali 
has been added to the dye-bath, in which case the rinsing must not be omitted.
Dyeing in old liquors.

In most cases a considerable saving is effected if dark shades are dyed in old liquors.

It is, however, very difficult to say how much colour can be saved in this manner. This depends upon the nature of the products used, the depth of the shades produced, the dilution of the liquors, and the amount of salts added.

With medium and dark shades an average of one-fifth to one-third of the colouring-matter is saved, but in certain cases the saving amounts to even as much as one-half of the dye used in the first operation.

For the second and following dyeings, at most only about one-fourth to one-fifth of the original quantity of Glauber's salt or common salt will be required.

Difficulties which may be encountered whilst dyeing:

1. When old liquors are used for a long time, the dirt which is present even in the boiled-off cotton accumulates, and if a mixture of several substantive dyes is used, the shades of the dyeings obtained may vary to a greater or less extent due to an unequal absorption of the various colours.

   The first circumstance may have an unfavourable influence on the purity of certain shades, and the latter makes the work more difficult, especially if a large quantity of yarn requires to be dyed in several lots to exactly the same shade.

   The remedy is self-evident.

   The choice of dyestuffs must be carefully made, i.e., only such colours as resemble one another as closely as possible in dyeing properties should be used together. One must also avoid using the liquors too long to dye the same fancy shades.

2. A difficulty which is frequently met with is that of mottled dyeings.

   How to avoid these in the dyeing process itself is discussed on page 144 (process c), and also on page 146.

   In addition it should be noted that if the water is so hard that an addition of soap is not permissible, and if for some reason the water cannot be previously corrected with soda, satisfactory results can frequently be obtained by entering the goods cold and then slowly heating up.

   The other precautions are the same as those which have been previously mentioned.
If the yarn becomes streaky after dyeing, it may be due to the yarn not having been rinsed as it came from the dye-bath. In several cases it may be caused by the yarn being dried at too high a temperature.

3. Several substantive dyes form difficultly soluble lime salts when added to hard water. If, therefore, a precipitate is observed to form in such water, the course to adopt in future cases is to soften the water used for dyeing as well as possible by boiling it with a little soda, before preparing the dye-bath for the colour in question with it. In this manner a partial loss of the colour and the consequent weakening of the shade is prevented.

After-treatment of substantive dyes in order to increase their fastness.

A series of substantive dyes are rendered faster to light or also against bleeding into white when washed, by subjecting the dyeings to an after-treatment with certain metal salts (copper sulphate, bichromate of potash).

For example, the following become faster to light if treated with copper sulphate:

- Sulphine diazotised and developed with soda (shade becomes somewhat fuller)
- Sulphine diazotised and developed with Beta-Naphthol (shade becomes claret)
- Sulphine diazotised and developed with Oxamine Developer M (shade becomes somewhat fuller)
- Thiazine Brown G, R (shade becomes browner)
- Phenamine Blue G, B, R (shade becomes greyer and duller)
- Oxamine Blue B (shade becomes somewhat duller)
- Oxamine Blue A (shade somewhat duller)
- Oxamine Blue RRR diazotised and developed with Beta-Naphthol (shade becomes somewhat fuller)
- Oxamine Violet diazotised and developed with soda (shade becomes much duller)
- Oxamine Violet diazotised and developed with Beta-Naphthol (shade becomes greyer)
- Oxamine Black N, A, diazotised and developed with Beta-Naphthol (shade becomes somewhat duller)
- Oxamine Violet diazotised and developed with Oxamine Developer M (shade becomes somewhat blacker)
- Oxamine Violet diazotised and developed with Oxamine Developer B (shade becomes much duller)
- Oxamine Red developed with Nitrosoamine solution (shade becomes dull claret)
- Oxamine Maroon developed with Nitrosoamine solution (shade becomes dull reddish brown)
- Oxamine Black N, A, diazotised and developed with Oxamine Developer M (shade unaltered).
The following also become faster to light but not to the same extent:

Cotton Yellow R (becomes orange)
Oxamine Violet (becomes duller)
Oxamine Red (becomes much duller).

The following become faster against bleeding into white if treated with copper sulphate:

Cotton Yellow G, GI, GR, GRR
Cotton Yellow R
Oxamine Blue RRR developed with Beta-Naphthol
Oxamine Violet developed with Beta-Naphthol
Oxamine Violet developed with Oxamine Developer B
Oxamine Black N, A, developed with Beta-Naphthol
Oxamine Red
Oxamine Red developed with Nitrosamine solution
Oxamine Maroon developed with Nitrosamine solution
Oxamine Black N, A, developed with Oxamine Developer M.

The following are also rendered somewhat faster in this respect:

Sulphine developed with Beta-Naphthol
Oxamine Blue B
Phenamine Blue G.

By treatment with bichromate of potash the following become faster to light:

Sulphine diazotised and developed with soda
Oxamine Blue B.

The following become faster against bleeding into white to a greater or less extent by treatment with bichromate of potash:

Cotton Yellow R
Oxamine Blue RRR developed with Beta-Naphthol
Oxamine Blue RRR developed with Oxamine Developer M
Oxamine Violet.

Treatment with bichromate of potash, copper sulphate, and acetic acid materially increases the fastness against washing in the case of:

Oxamine Blue B G.

As a rule copper sulphate increases the fastness to a greater extent than bichromate of potash.
Appendix to method 1, page 143.

Working with sulphur dyes.


When working with the various sulphur dyes, copper or tin-plated vessels or apparatus containing these metals must be avoided.

For this reason wooden dye-vats and iron dyeing apparatus are used, and on account of the alkalinity of the liquors the yarn is turned with a stick.

In all cases it must be well washed immediately after dyeing in a large quantity of cold water.

Kryogene Brown.

This product can be dyed in a hot or cold bath. It is used for producing very fast brown shades. It is usually dyed at 120° F., and a quantity of common salt equal to twice the weight of the dyestuff used is added to the bath.

About the following quantities of colour are required when preparing a fresh bath for 100 lbs. of cotton:

For light brown: 5—7½ lbs. of Kryogene Brown.
For medium brown: about 15 lbs. of Kryogene Brown.
For dark brown: about 25—30 lbs. of Kryogene Brown.

The quantity of water used should not exceed 125—130 gallons.

Notes.

1. When working with old liquors about ¾ of the original amount of brown is all that is required to replenish the bath each time.

2. The following substantive dyes are the most suitable for shading Kryogene Brown in the same bath:


3. For subsequent brightening in a fresh bath the basic dyes are used, e.g.:—

   Auramine II. Rheonine A. Vesuvine extra. Cerise DIV. The Methyl Violet brands. Diamond Green B.
Kryogene Brown G.

This product gives yellower and considerably fuller shades than Kryogene Brown. Its property of dyeing level shades is not so good as that of the latter brand, and in order to obtain level dyeings it is necessary to add a comparatively large quantity of sodium sulphide to the dye-bath.

In order to produce a medium shade on 100 lbs. of cotton yarn, prepare the 1st dye-bath with:—

10 lbs. Kryogene Brown G
20 » sodium sulphide
5 » calcined soda
10 » common salt

about 200 gallons of water.

Enter the boiled out and hydro-extracted yarn into the hot bath (for light shades it is better to enter warm), turn several times in succession, later on only at intervals of about 10 minutes.

Dye for \( \frac{3}{4} \) — 1 hour at the boil. Subsequently the yarn is best taken out, one rod at a time, each hank is wrung out as quickly as possible and thoroughly rinsed without delay.

Remarks.

The dyestuff is dissolved together with sodium sulphide and soda by pouring boiling water over the mixture and stirring until solution is complete. This solution is then poured into the dye-bath to which the common salt has already been added.

If necessary Kryogene Brown G can also be dyed in a cold bath. For further working in an old bath, only about \( \frac{1}{2} - \frac{3}{4} \) of the original quantity of dyestuff and an equal weight of sulphide is required to produce the same shade on 100 lbs. of cotton yarn. Also for every gallon of water added to fill up the bath again, add a quantity of common salt and soda which is proportional to that which was added to the first bath. For example, the following quantities will be required for replenishing the above-described dye-bath:—

6 lbs. 9\( \frac{1}{2} \) oz. Kryogene Brown G
6 » 9\( \frac{1}{2} \) » sodium sulphide
2\( \frac{1}{2} \) lbs. calcined soda
5 » common salt

per 100 gallons of water added.

Note.

The shades of dyeings produced with Kryogene Brown G are comparatively fast to storing. No improvement is produced by after-chroming.
Kryogene Olive.

For this product the same dyeing process which has been described for Kryogene Brown G can be used. In this case, however, a considerably less quantity of sodium sulphide is used, both for the first and following baths.

The amount of sodium sulphide required is about 30% of the weight of the dyestuff taken, e.g., in the above recipe 10 lbs. of dyestuff would require 3 lbs. of sodium sulphide.

As already mentioned on page 73, the shades produced with this colour become greyer and duller on storing. For this reason it is only used to a limited extent.

Kryogene Blue R, G.

The brand R gives clear reddish shades, whereas those obtained with G are greener and fuller.

The dyestuff is dissolved with about three times its weight of sodium sulphide and then added to the bath.

The dyeing takes place cold, and for dark shades a quantity of common salt equal to 5 times the weight of the Kryogene Blue is added to the bath.

Anthraquinone Black.

The best method of dyeing with this product is to use concentrated solutions and to dye at the boil. A quantity of sodium sulphide equal to half the weight of the Anthraquinone Black used is added, and also 10—20 lbs. of common salt for every 20 gallons of liquor.

For producing a very deep black on 100 lbs. of yarn, the first bath is prepared with:—

25 lbs. of Anthraquinone Black
12 » » sodium sulphide
130 » » common salt
130 gallons of water.

The second and following baths require about:—

20 lbs. Anthraquinone Black
5 » » sodium sulphide
10—11 » common salt.

The sodium sulphide and colour are dissolved together by stirring with boiling water.
After the solution obtained in this manner has been added to the bath, the salt is thrown in, and the dye-liquors are raised to the boil.

The wetted out (hydro-extracted) yarn is then entered and turned 6—8 times with a stick. It is now taken out, the liquors are raised to the boil, the steam is turned off and the yarn is again entered and turned for another half hour. It is then carefully wrung out and the liquor from it is returned to the dye-bath.

The dyed yarn must immediately be thoroughly rinsed after which it is generally oxidised at 120° F. with 3—5 lbs. of bichromate of potash and an equal quantity of sulphuric acid 168° Tw.

This treatment with bichromate can be omitted where the maximum fastness is not required, and the yarn is topped in a fresh bath with Methylene Blue and Safranine with the addition of 1—2 lbs. of copper sulphate.

Notes.

1. In order to work as cheaply as possible, it is advisable to use as little water as one can.

2. When dyeing with Anthraquinone Black it is neither necessary nor advisable to turn the yarn very often. One can therefore easily dye 4 lbs. of yarn on one rod.

3. If the shade of the black is found to vary with different lots, it may be due to allowing the yarn to hang in the air too long before chroming, or to chroming it too severely (i.e., at too high a temperature or with too much chrome). In both cases the tendency is to give redder shades.

4. If the yarn has not been rinsed sufficiently well after dyeing the black will be liable to rub off somewhat.

Patent Kryogene Black B, BG, and G.

Dyeing process.

For 100 lbs. of cotton yarn.

Prepare the dye-bath as follows:—

20 lbs. of Kryogene Black B, BG, or G
10 » sodium sulphide
10 » calcined soda
40 » common salt (if necessary calcined Glauber’s salt) and
200 gallons of water.

Enter the cotton yarn after boiling it out, and hydro-extracting it, into the hot bath and turn it a few times with a stick without interruption. Sub-
Cotton Yarn. Dyeing without mordant with sulphur dyes.

sequently it need only be turned once in about ten minutes. Care must be taken to immerse the yarn as completely as possible in the dye vat.

The dyeing occupies about one hour and is effected at a temperature of 160—175° F. It is then best to remove the yarn from the bath, taking it out one rod at a time, and to wring out each hank as quickly as possible and rinse without delay. In order to obtain greater beauty and fastness (also to prevent it as far as possible from becoming bluer on storing) the yarn is next treated in a bath to which are added:

- 2 lbs. sulphate of copper
- 2 » bichromate of potash and
- 3 » acetic acid 9° Tw.

Turn the yarn in this bath for about half an hour at about 160—170° F. and then rinse thoroughly.

**Brightening.**

A further and considerable improvement of the shade can be obtained by subsequently brightening.

- 2 lbs. potato flour or starch and
- 2 » lard, cocoa-nut oil, &c.

are thoroughly well boiled together and added to the brightening bath which should have a temperature of 140—160° F. Turn the yarn about five times in this bath. The beauty of the shade is still further increased, and to a considerable degree, by the addition of 6½ lbs. of Turkey-red oil to the brightening bath.

Another method of brightening which possesses the advantage of leaving the cotton much softer is as follows:

- 14 oz. soap
- 14 » olein
- 14 » cotton oil (olive oil or rape oil)
- 14 » ammonia

are boiled up well together and then added to the brightening bath which should have a temperature of 160—175° F. The yarn is worked in this as above described. A still further increase in the beauty of the shade is obtained by adding 4½—6½ lbs. Turkey-red oil.

**Notes.**

The colouring matter is dissolved by mixing it with the sodium sulphide and pouring boiling water on to the mixture and stirring until solution is complete. This is then added to the dye-bath.
When dyeing in old liquors the bath is replenished for every 100 lbs. of yarn with about:

- 12 lbs. of Kryogene Black B and
- 4 » of sodium sulphide.

If when working with Kryogene Black B and BG, difficulty is met with in obtaining level shades (this is not likely to occur with the brand G) the ordinary means adopted for this class of colouring matters can be applied, that is, instead of using the wooden rods for dyeing, the well-known bent gas pipes bound with cotton are used.

In this way it is possible to keep the yarn completely immersed in the vat.

For many purposes the above described after-oxidation of the black with bichromate of potash and copper sulphate, &c., or with copper sulphate, &c., can be omitted. It should, however, be noticed that one of the several effects of this treatment is to prevent the black from becoming too bluish on storing and thus appearing emptier.

When not in use the Kryogene Black liquors should always be kept covered up. They can then be used for several months. (With regard to the replenishing of the vats, see above.)

**Fast Black B, BS.**

Dye in cold concentrated liquors. For 100 lbs. of yarn the first bath is prepared with about

100 lbs. Fast Black
100 » sodium sulphide
100—150 gallons of water

(about 10—15 times as much water as yarn).

The Fast Black and sodium sulphide are dissolved together by stirring with hot water in a wooden tub. This solution is then poured into the cold water to be used when dyeing, contained in a wooden dye-vat.

The yarn is turned for some time in this liquor with a stick, using indiarubber gloves, until it is wetted sufficiently, after which it is allowed to remain fully immersed in the liquid for 1 hour. It is finally wrung out as well as possible, and thoroughly rinsed.

Dyeing in old liquors.

In many cases the Fast Black liquors are used for months. For every 100 lbs. of yarn the bath is replenished with 35—40 lbs. of dyestuff and an equal quantity of sodium sulphide.
Notes.

The Fast Blacks are very sensitive to metallic copper, copper salts, bichromate of potash, chlorine, &c.

The brands B and BS differ from each other in shade. The former gives a more bluish black and the latter a deeper black shade. For most purposes both of these products can be replaced by the Kryogene Blacks which are cheaper and more beautiful in shade.

Cotton Red S.

Dyeing process.

For 100 lbs. of cotton yarn.

The dye-bath is prepared from about 150 to 160 gallons of water, and the solution of the colouring matter. To this is added 145 lbs. of common salt. Boil up thoroughly and enter the wetted out yarn into the boiling vat and turn for about half an hour to one hour and then take out the yarn and rinse.

Notes.

The shade becomes somewhat brighter by acidifying in a bath containing 6½ to 11 lbs. of sulphuric acid of 168° Tw.

When dyeing in old liquors only about three-fourths of the quantity of the colouring matter used at first need be added. Sufficient common salt should be added to replace that lost with the previous batch of yarn, say about 15 to 20 lbs. per 100 lbs. of yarn.

Dissolving the colouring matter.

Mix the colouring matter with double the quantity of caustic soda 76° Tw. and a little hot water, and then add sufficient boiling water to obtain complete solution.

2. Topping cotton which has been grounded with substantive dyes

with basic colours.

The ground produced by dyeing cotton with substantive or sulphur dyes acts as a mordant towards most basic colours so that moderately large quantities of the latter can be fixed on the cotton without further treatment.

The chief advantage of this method of working is its simplicity, but the fastness of several of the shades produced in this manner is also comparatively good. Of
course the shades will be the faster, the nearer that of the ground colour and the colour used for topping approach each other. For instance, faster dyeings will generally be obtained by topping a green substantive ground with a green basic dye, than by topping a yellow substantive ground with a green or blue basic dye.

The method of working is very simple and consists in topping the cotton which has been grounded, in a fresh, cold or lukewarm bath with basic dyes.

If these are absorbed too rapidly, a little acetic acid or alum must be added, (this is assuming that the ground colour is sufficiently fast to acid) or the colour solution must be added gradually to the dye-bath.

Indoine Blue is an exception; it is not dyed as above described, nor is the substantive ground necessary for fixing it. When used for this purpose, it must always be dyed at the boil with an addition of alum or aluminium sulphate. (See note 11, page 485.)

Notes.

If the ground has been produced with substantive dyes in presence of soda, potash, or large amounts of common salt, the yarn must as a rule be slightly rinsed before topping it.

If on the other hand only Glauber's salt has been used, the rinsing is generally omitted.

A method by which the colour used for topping can be rendered faster may also be mentioned here, although it really should come under the heading of dyeing on a mordant.

Between $3^{1/2}$ and $4^{1/2}$ lbs. of tannic acid (or a corresponding amount of some other tannin substance) are added to the dye-bath for every 100 lbs. of yarn. Nothing more must be added to the bath except common salt or Glauber's salt and the substantive colour solution.

The yarn is dyed for $3/4$ hour at the boil and then turned slowly for 1 hour whilst the bath is allowed to cool down. It is then hydro-extracted, worked in a cold bath containing $1^{1/2}$ lbs. of antimony salt, after which it is topped in the ordinary way with basic dyes.

The process is also frequently effected by first grounding with the substantive dye, then mordanting with a tannin substance and antimony salt and finally topping with the basic dye.

The following process can also be considered as belonging to method of working No. 2.

Grounding with Cachou de Laval and topping with basic colours.

This process is only of real value when fast drab shades are dyed which require just to be brightened with Aniline Colours of a similar shade.
Cotton Yarn. Dyeing without mordant with an addition of alumina salts.

If one were,—by topping with suitable anilines,—to produce shades quite different from that which Cachou de Laval gives by itself, the action of light and washing would alter the colour very considerably.

Cachou is generally dyed with an addition of common salt and then fixed with bichromate of potash. (Copper sulphate, ferrous sulphate, hydrochloric acid, or sulphuric acid may be used in place of the latter. They all give similar shades which are, however, not quite so fast.)

Cachou is topped with basic dyes in exactly the same way as a ground which has been produced with substantive dyes.

Cutch gives dyeings which are very similar in properties to those produced with Cachou. The former has, however, the advantage that ground colours can be produced with it which vary from a gray and yellowish brown to a reddish brown.

This is done by making a suitable choice of the various commercial brands (gambier, cutch, &c.) and of the different fixing agents (bichromate of potash, iron salts, &c.).

The topping with basic colours on cutch is also faster than on Cachou, as the former contains tannin substances.

For working with cutch refer to page 175.

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3. Dyeing with an addition of alum or aluminium sulphate to the liquors.

Several basic colours, e.g., Victoria Blue B, 4 R, Indoine Blue BB, BR, BBN give full shades on unmordanted cotton, which, although not so beautiful and fast as those produced on a mordant, are good enough for several purposes.

For dyeing 100 lbs. of yarn with Victoria Blue add 1—2 1/4 lbs. of sulphate of alumina or 2 1/4—4 1/2 lbs. of alum to the dye-bath. Enter the goods lukewarm, raise slowly to the boil, turn off steam and work for some time while the bath is cooling down. Finally dry at a moderate temperature without rinsing. When working according to this method, the liquors should be kept as concentrated as possible; about 132 gallons of water are required for the above quantity of yarn.

(In place of the alumina salts an emulsion of oil and sulphuric acid can be used.)

Indoine Blue is also dyed as above described, but it must be boiled for at least 1/2 hour and lightly rinsed. The most suitable mordant is sulphate of alumina and for light shades 6 oz., for medium shades 3 oz., and for dark and very dark shades 1 1/2—3/4 oz. are required for every 20 gallons of water.
One should notice that a prolonged boiling, and the addition of increased quantities of sulphate of alumina, turn the shade of dyeings with Indoiine Blue greener, and also that under these conditions the most level dyeings are obtained.

If, on the other hand, when producing very dark shades too much alumina salt is added, the liquors will not become sufficiently clear.

4. Dyeing with an addition of sodium stannate and sulphuric acid to the dye-liquors.

This method is used for producing bright light to medium shades with Soluble Blue and in many dye-works it is highly prized on account of its simplicity.

The method of working is as follows:—

For 100 lbs. of yarn prepare the 1st bath with:—

2 — 3 lbs. of dyestuff
2 » » sodium stannate
1 lb. » sulphuric acid 168° Tw.
130 gallons of water.

Enter the yarn at about 175° F., turn 4—5 times, wring out or hydro-extract, and dry without rinsing.

For the 2nd and following lots, add ¹⁄₄ of the above-mentioned quantity of sodium stannate and sulphuric acid and an amount of dyestuff corresponding to the shade required.
5. Dyeing in a concentrated lukewarm or cold bath containing salt.

This method is only used for the dyes of the Eosine group, and then only in such cases where fastness to washing and light is of little importance and where the chief aim is beauty of shade.

When working according to this process the concentration of the bath is of special importance. For dark shades, the quantity of water used should not exceed 10 times the weight of the cotton.

The fixing agent used is common salt, and for the first bath 1 lb. is added for every 2 gallons of water. This gives a solution which stands almost exactly at 6° Tw.

The yarn is entered at a temperature of 100—140° F. and turned for \( \frac{1}{2} - \frac{3}{4} \) hour whilst the bath is cooling down. Finally it is wrung out lightly and evenly, shaken out but not rinsed, hydro-extracted, and dried at a very moderate temperature. The best way is to dry it in the open air.

One must avoid touching the yarn with wet fingers, and dry hydro-extractors should also be used.

The yarn can be dyed in a cold bath instead of in a warm one as above described, but in this case it does not wet out so well.

For very full shades, 10 \( \% \) of dyestuff on the weight of the yarn must be used for the first bath. For 100 lbs. of yarn this is prepared with

\[
\begin{align*}
10 \text{ lbs. of dyestuff} \\
50 \text{ » » common salt} \\
100 \text{ gallons of water (10 of water to 1 of yarn).}
\end{align*}
\]

The liquors are by no means exhausted, and the amount of colour for the second and following baths can be considerably reduced.

For the second bath one requires about:

\[
\begin{align*}
2 \frac{3}{4} \text{ lbs. of dyestuff} \\
37 \frac{1}{2} \text{ » » common salt.}
\end{align*}
\]

For the third bath only:

\[
\begin{align*}
2 \frac{1}{2} \text{ lbs. of dyestuff} \\
25 \text{ » » common salt.}
\end{align*}
\]
Cotton Yarn. Dyeing without mordant in a bath containing common salt.

For the following baths always about:—

\[ \begin{align*}
2\frac{1}{2} \text{ lbs. of dyestuff} \\
20 \quad \to \quad \text{common salt.}
\end{align*} \]

For shades of medium depth one requires for example: —

1st lot

\[ \begin{align*}
5 \text{ lbs. of dyestuff} \\
25 \quad \to \quad \text{common salt.}
\end{align*} \]

2nd lot

\[ \begin{align*}
1\frac{3}{4} \text{ lbs. of dyestuff} \\
18\frac{3}{4} \quad \to \quad \text{common salt.}
\end{align*} \]

3rd and following lots

\[ \begin{align*}
1\frac{1}{2} \text{ lbs. of dyestuff} \\
15 \quad \to \quad \text{common salt.}
\end{align*} \]

For light shades one requires for example: —

1st lot

\[ \begin{align*}
2\frac{1}{2} \text{ lbs. of dyestuff} \\
15 \quad \to \quad \text{common salt.}
\end{align*} \]

For the following lots always about: —

\[ \begin{align*}
13\frac{1}{2} \text{ oz. of dyestuff} \\
10 \quad \text{lbs. } \to \quad \text{common salt.}
\end{align*} \]

The liquor which is wrung out and hydro-extracted from the yarn must of course be carefully collected and added to the bath again before fresh additions are made.

The following Eosine brands are absorbed fairly well by cotton: —

6. **Dyeing** in a concentrated lukewarm (or cold) bath with an addition of common salt and alum.

This method is used for producing very bright red, orange, and yellow shades with acid dyes. The dyeings obtained in this manner are not at all fast to washing, but on an average they are fast to light.

The following are specially suitable: —

For clear scarlets: —

*Cotton Scarlet extra. Erythrine RR. Scarlet RA.*

For bluish red: —

*Erythrine X, P.*

For orange: —

*Orange X, GR.*

For yellow: —

*Quinoline Yellow. Azoflavine S, RS, &c.*

The following are also used but they do not exhaust so well as the above: —

The *Scarlet-* and *Fast Scarlet* brands. *Naphthol Yellow S. Tartrazine.*

The method of working is very similar to No. 5 on page 160. The yarn is entered at 100 — 140 °F. and worked for 1/2 — 3/4 hour whilst the bath cools down. Finally without rinsing it is wrung out very evenly (or lightly wrung out and then hydro-extracted), shaken out and then dried at a medium temperature.

In this case also it is best to dry in the open air.

For dyeing a very full scarlet on 100 lbs. of yarn, for example, prepare the first bath with about: —

10 lbs. Cotton Scarlet  
2 » alum  
20 » salt  
100 gallons of water (10 of water to 1 of yarn.)
Cotton Yarn. Dyeing without mordant with an addition of common salt and alum.

As the liquors, just as in process No. 5, are not exhausted, that which is wrung out, or hydro-extracted from the yarn must be collected and poured back into the bath again. The latter is then prepared for a fresh lot as described below.

For a second lot dyed in an old liquor add about:

- 2 1/2 lbs. Cotton Scarlet
- 1 1/2 » alum
- 15 » common salt.

For the third and following lots about:

- 2 lbs. Cotton Scarlet
- 1 lb. alum
- 10 lbs. common salt.

For medium shades:

1st lot
- 5 lbs. Cotton Scarlet
- 2 » alum
- 20 » common salt.

2nd lot
- 1 3/4 lbs. Cotton Scarlet
- 1 1/2 » alum
- 15 » common salt.

3rd and following lots
- 1 1/2 lbs. Cotton Scarlet
- 1 lb. alum
- 10 lbs. common salt.

For light shades:

1st lot
- 2 1/2 lbs. Cotton Scarlet
- 1 1/2 » alum
- 15 » common salt.

2nd and following lots
- 13 1/2 oz. Cotton Scarlet
- 1 lb. alum
- 10 lbs. common salt.
7. Dyeing in a lukewarm bath which has been slightly acidified with acetic acid.

This method is generally used for producing pink shades with *Rhodamine S*, or very light shades with *Rhodamine 6G*.

In both cases the yarn is dyed in a lukewarm bath, to which 1—2 oz. of acetic acid 9° Tw. have been added for every 6 gallons of water, the exact amount depending on the degree of hardness.

The brightest and most delicate shades are obtained—especially in the case of *Rhodamine 6G*—on bleached yarn previously subjected to a hot soaping and then rinsed.

The amount of dyestuff required varies from 1½ oz. to 1 lb. of Rhodamine S or 1—12 oz. of Rhodamine 6G for 100 lbs. of yarn.

If more than the maximum amount stated above is used, the shade obtained will not be any darker.

8. Dyeing in the size.

For various reasons this method is described later on, see page 229.
Dyeing mordanted cotton yarn.

1a. Mordanting with tannin substances and antimony or iron salts.

For 100 lbs. of cotton yarn the tannin bath is prepared with about 130—150 gallons of water.

The mordanting process is always the same, whatever tannin substance is used, i. e., the yarn is turned 6 times in the hot mordanting liquor and for dark shades it is then left immersed in it overnight. The yarn must be entirely covered by the liquid. (For light shades 1/2—2 hours mordanting is sufficient.)

In the morning the yarn is wrung out or hydro-extracted without being previously rinsed. It is then turned 6 times in a cold bath containing antimony salt, which causes the tannic acid to be precipitated on the fibre as an insoluble antimony compound. After this it is rinsed in order to remove any loose precipitate from between the fibres, it is then wrung out and shaken, after which it is ready for dyeing.

If in place of antimony salt the tannic acid is fixed by an iron mordant which also acts as a darkening agent, the yarn must be worked in the cold dilute liquors until the required depth of shade has been obtained. To determine this point a certain amount of experience is required, as the colour always becomes darker on keeping, due to the oxidising action of the air and the lime in the water. In many dye-houses this is hastened by wringing out the yarn and then hanging it in the loose condition in the air for 1/4—1/2 hour. After this it is rinsed.

If a deep black ground is required it is often necessary to repeat the whole process, i. e., to pass the yarn through the old tannin bath and iron liquors again. (See page 289 and following pages on unions.)

When dyeing better class goods, one should bear in mind that the basic dyes are fixed better by dyeing on a mordant of tannic acid and antimony salt than on a mordant of tannic acid and iron salts.

In addition to this, it is often the case when producing dark but bright shades, that a sufficiently large quantity of iron mordant cannot be used to fix the whole
of the tannin because it would destroy the brightness of the shade. This again would still further impair the fastness and also give rise to other difficulties. (Uneven dyeings, precipitation of colour lake in the dye-bath.)

For these reasons it is advisable to first fix the whole of the tannin with antimony salt and then to submit the yarn to a suitable treatment with iron salts. This is best carried out in a fresh bath, as an after-addition of iron mordant to the acid antimony bath only acts very incompletely as a darkening agent. This is especially the case if instead of tartar emetic other antimony preparations are used which possess a more acid reaction.

If for some reason, e. g., when producing a very light iron ground, it is desired that the darkening with iron should take place very slowly, it can of course, as follows from the above, be effected by adding the iron mordant to the antimony bath.

**Tannins.**

The following are the tannin substances which are chiefly used for cotton:

- Tannic acid
- Sumach leaves
- Sumach extract
- Myrabolans
- Gall-nuts.

Divi-Divi and Quebracho wood, &c. have also been introduced in several industries.

As a rule the most convenient and reliable to work with is tannic acid, for it presents but slight variations in quality when definite brands are bought from respectable dealers.

Certain basic dyes give somewhat clearer shades with gall-nuts than with tannic acid, but still the difference is so small that it is of practical importance in only a very few cases.

When using gall-nuts, one should bear in mind that the amount of tannic acid in the various commercial brands differs very considerably, and therefore purchases should be made entirely dependent on an exact statement regarding the latter.

Chinese gall-nuts are the best; they contain up to 70% of tannic acid.

Sumach leaves are used where the somewhat duller shade of the mordanted cotton is of no consequence. They are quite reliable to work with, in as much as after a little practice one can judge their quality by noticing the external appearance.
and the smell of the leaves. Good leaves should contain about 15% of tannic acid, as
determined by analysis, but experience shows that their practical value in com-
parison with tannic acid is generally greater than this.

The disadvantages of powdered sumach are, that one cannot judge from the external appearance whether its quality is up to standard and also the decoction is difficult to filter.

Liquid sumach extracts are well liked because they are so convenient to work with. Nevertheless they should be adopted with caution because they can be so easily adulterated, and they are also subject to fermentation which reduces their value.

The first difficulty can be overcome by carefully choosing the retailer and the latter by storing and using them carefully.

The value of sumach extract is very often over-estimated by the consumer, for it generally comes in considerably more expensive than sumach leaves.

Myrabolans are liked for many purposes because they contain a natural dyestuff which imparts a yellow shade with a certain amount of covering power to the cotton that is mordanted with them.

A series of comparative trials which were made to test the practical value of various tannins gave the following figures:

5 lbs. of tannic acid equal
20 » » sumach leaves 1a
9—10 » » sumach extract 68° Tw.
7 » » Chinese gall-nuts (70°/o tannic acid)
15 » » myrabolans.

These values have been obtained by using the substances in question in fresh mordanting baths and working under the same conditions in each case. They differ to a certain extent from the figures obtained by analysis, as these mordants contain chemically different tannins which do not behave in the same manner.

Tannic acid and sumach extract are prepared for adding to the mordanting bath by simply dissolving them in hot water.

Sumach leaves in the form in which they are placed on the market are boiled for 20—25 minutes. The simplest method is to weigh out the necessary quantity into a rough sack, which is then tied up and hung in a quantity of boiling water in the mordanting vat sufficient to work the cotton in.
Cotton Yarn. Work on a tannin mordant.

After it has been boiling long enough, the sack is taken out and laid on two rods which are placed across the vat so that it can drain a little and that the liquid can run back again into the vat. The leaves are then thrown away as useless.

Myrabolans and gall-nuts must first be reduced to a coarse powder before they are used. They are then treated in the above manner or boiled out in a wooden vat.

In some districts powdered sumach is extracted by steeping it for one day in cold water, as in this manner a smaller quantity of resinous substances, which exert an unfavourable influence on filtration, are obtained in solution.

All alkalies and also water containing bicarbonate of lime tend to decompose tannic acid. It is therefore always advisable to add a little acetic acid to the water which is used for mordanting, and this is especially the case when working with very hard water.

With regard to the use of old mordanting liquors, see note 6, page 291, on unions.

Antimony mordants.

The following are the most important antimony mordants that are used at the present time for fixing tannic acid:

- a) tartar emetic (antimony potassium tartrate)
- b) antimony salt (double salt of antimony fluoride and ammonium sulphate)
- c) patent salt (double salt of antimony fluoride and ammonium fluoride)
- d) antimony oxalate (double oxalate of antimony and potassium)
- e) antimonine (antimony lactate).

Tartar emetic which was formerly exclusively used has recently been extensively replaced by the double salts of antimony fluoride for cotton dyeing.

All these products answer their purpose perfectly well, but it might be mentioned here that tartar emetic and antimonine have not such an acid reaction as the fluoride salts. In those cases where this property it desired (e.g., when working with metal vessels, in calico printing, and when dyeing materials consisting of cotton and silk) tartar emetic is still used and to a certain extent antimonine.

The disadvantage of the oxalic acid compounds in comparison with the other antimony mordants is that they give a precipitate of calcium oxalate in hard water; for this reason the goods must be thoroughly rinsed when they are used.
Cotton Yarn. Work on a tannin mordant.

For fixing tannic acid one always uses a larger quantity of antimony mordant than is required according to chemical calculation. This is done in order to be quite certain that the whole of the tannic acid is fixed. When working on a practical scale 2 parts of antimony salt or tartar emetic are used for 5 parts of good tannic acid.

Iron mordants.

The following preparations are used for fixing tannic acid by means of iron:

a) pyrolignite of iron
b) the so-called nitrate of iron
c) ferrous sulphate (green vitriol).

The cheapest of these is green vitriol, but it has not nearly the same darkening effect as pyrolignite—or nitrate—of iron. Pyrolignite of iron is extensively used in cotton dye-houses. It is produced by dissolving scrap iron in pyroligneous—or crude acetic—acid, and is placed on the market in the form of a dark liquid possessing a peculiar burnt smell which has generally a concentration of 25° Tw.

If one wishes to produce a more beautiful iron grey or iron black, or to avoid the smell which is objectionable for several kinds of goods, it is replaced by nitrate of iron.

This is supplied as a deep reddish brown liquid which generally stands at 90° Tw. The active part is chiefly ferric sulphate and it at most contains small quantities of nitric acid as impurity. The name nitrate of iron is therefore incorrect and arises from nitric acid being used in its manufacture.

This product is used in very large quantities in works which dye blacks on silk, and formerly it was as a rule prepared on the premises. At the present time, however, it is prepared as a speciality in chemical works and is always delivered of the same composition to the consumers.
Having given a short description of the mordants themselves, we will now consider the difficulties which sometimes arise when mordanting cotton.

Difficulties in mordanting.

Streaky yarn.

Yarn which has been correctly treated should appear perfectly even after being mordanted. If this is not the case, one cannot expect to produce sufficiently level dyeings on it, especially in light shades.

Long streaks in the yarn may be caused by:

a) The various kinds of cotton composing the yarn being badly mixed. One can generally ascertain if this is the case by carefully examining the raw yarn, but in many cases it is more conspicuous after the yarn has been mordanted or dyed.

An improvement can often be brought about by treating the yarn with acid after it has been boiled out (see page 138, note 2).

b) Letting the yarn stand too long after boiling out or mordanting (so that parts of it become dry), especially if it is also acted upon by the sun's rays.

This can be prevented by using the yarns immediately.

c) Boiling out with soda and not rinsing sufficiently and then omitting to hydro-extract. The injurious action of the soda thus introduced into the mordanting liquor by the yarn will be counteracted by an adequate addition of acetic acid to the mordanting bath. It is, however, more rational to rinse sufficiently after boiling out.

d) By using water which contains a large amount of iron.

The streaks produced in this manner can be recognised by their colour which is more or less gray. They can be avoided by adding a little hydrochloric acid to the mordanting bath.
Cotton Yarn. Work on a tannin mordant.

e) When bleaching cotton yarn using water which contains iron or permitting different parts of the yarn to be unequally affected by the bleaching powder solution. In either case the remedy is obvious.

Streaks which run across mordanted yarn are generally caused by using dirty sticks.

Rods that have been soaked with iron mordant are specially injurious to yarn which has been mordanted with tannic acid and antimony salt, as they give rise to grey streaks which run across the yarn. The cause of such streaks can easily be recognized from their appearance.

When working with a mordant of tannic acid and iron, those sticks must be avoided which have been used for acid liquors, e. g., rods which have been used for souring vat-dyed yarn. These rods give rise to light streaks which run across the yarn.

Irregular blotches.

The presence of these on mordanted yarn can usually be traced back to using dirty liquors or hydro-extractors, or to splashing with some liquid or other and they really do not require to be mentioned here.

These defects cannot originate in the mordanting process itself, with the exception of light parts caused by allowing part of the yarn to remain above the surface of the liquid after the rest has been pushed below. In most cases such spots are not noticed in the mordanted yarn and can only be seen after the dyeing process.
1b. Dyeing of yarn which has been prepared with tannin-antimony or tannin-iron mordant.

As we have already mentioned, this process is almost exclusively used for basic colours and it is only used in very few cases for products of another nature, e.g., Soluble Blue, Dark Green in paste.

Suitable method of working.

On an average 100 lbs. of yarn require about 180—190 gallons of water. If hard water is used for preparing the dye-bath and sensitive basic colours are to be used, it must first be corrected by adding $\frac{1}{2} - 2\frac{1}{2}$ pints of acetic acid 9° Tw.

The colour solution is generally added in three portions whilst dyeing.

The first third of the colour solution is added through a fine hair-sieve to the cold dye-bath which must then be stirred up. The yarn which has just been mordanted is now entered and turned 5—6 times. It is then taken out, the second third is added and the yarn is turned 5 or 6 times again, and so on.

After the last third of the colour solution has been added and the yarn has been taken out of the liquid, the temperature of the bath should be raised to about 105—115° F., and the dyeing is then finished by working for $\frac{1}{4} - \frac{1}{2}$ hour at this temperature.

If the dyestuff is then not completely exhausted, the yarn should be allowed to remain in the bath until the next lot is ready, and during this period it is turned a few times. Finally rinse and hydro-extract, or wring out.

Fine yarns should be shaken out before drying and with delicate shades the water in the yarn should be evenly distributed, after which the yarn should be shaken out. On an average the time required for dyeing is 1—1 1/2 hours.

Notes.

a) If the dyeings come up irregular and badly penetrated and there is reason to believe that this is not due to faulty mordanting of the yarn, the difficulty can be frequently overcome by adding 1—2 lbs. of alum (per 100 lbs. of yarn) to the dye-liquor.

It is best to turn the yarn several times in the water to which the alum has been added before the colour solution is poured in.
Cotton Yarn. Dyeing on a tannin mordant.

If this does not bring about a sufficient improvement more dilute solutions must be used (especially for light shades) and special care must be taken to turn the yarn quickly after the first lots of colour solution have been added.

The above-mentioned quantity of alum must never be increased when dyeing cotton which is mordanted with tannin and iron, or the ground colour would be injured. (It might be mentioned here that yarn which has been properly mordanted with tannin and iron is not nearly so liable to dye unevenly as that which has been mordanted with tannin and antimony.)

b) If the dyestuff is absorbed too rapidly by the cotton, the colour will as a rule not penetrate into the yarn sufficiently and will be liable to rub off. If the above-mentioned addition of alum does not counteract this, the mistake will in most cases be due to the yarn having been too strongly mordanted.

A less quantity of mordant should therefore be used for the next lot to see if an improvement can be effected.

c) If when dyeing medium shades the colour is absorbed very slowly or not at all, too little mordant has been used or its quality was bad.

When dyeing dark shades, one must bear in mind that many basic colours are not absorbed at all beyond a certain point, even though the yarn has been very strongly mordanted. Such difficulties generally begin to be noticeable when as much as \(2\frac{1}{2}\) lbs. of colour have been used for 100 lbs. of yarn.

d) A powdery insoluble precipitate is sometimes observed to form in the liquors during the dyeing process, due to the production of a tannin lake. In this case the yarn has not been rinsed after working it in the antimony bath or the antimony mordant used has not been sufficient to fix the whole of the tannin in the yarn.

e) When dyeing with Dark Green in paste about 3 lbs. of calcium acetate must be added to the bath for every 10 lbs. of colour used.

f) Several colours, e.g., Methylene Blue, Marine Blue, Nile Blue A, B, B, Victoria Blue B, R, 4R, and Night Blue give faster and more beautiful dyeings if the temperature of the dye-bath is finally raised to 160° F.
In order to obtain the maximum degree of fastness, with the various Indoise Blue brands the dye-liquor should be boiled for \(\frac{1}{2}\) hour after the colour has been absorbed. In this respect, however, the Indoise Blues are unique.

A full description of the method of dyeing Indoise Blue and also a table which gives the quantities of mordant and alum required, is to be found on page 482 in the appendix.

With the method which has just been described, viz., dyeing on yarn first impregnated with tannin and antimony, can be grouped a process which we published in 1890, in which the mordant and dyestuff are used in the same bath.

This method is specially adapted for dyeing with the Soluble Blues, but is also gives good results when used for light shades produced with dyestuffs of a purely basic character, e.g., Auramine, Saffranine, Magenta, Methylene Blue, Diamond Green.

The details of working are as follows:

For every 100 lbs. of yarn add \(4\frac{1}{2}\) lbs. of acetic acid 9\% Tw. to the dye-bath, or as a cheaper substitute, 1 lb. sulphuric acid 168\% Tw. and also a solution of 1 lb. of tannic acid. (A corresponding amount of some other tannin substance could also be used.) Enter the yarn which has just been boiled out and dye at 105—120\% F.

Notes.

If hard water is used, the addition of acid must be correspondingly increased, even up to twice the above-mentioned amount.

If the tannic acid colour lake requires to be rendered faster than that which is obtained as described above, the yarn should be subjected to an after-treatment with antimony salt. It is most convenient to add the latter to the first rinsing bath.
2. Grounding with cutch and metal salts and topping with basic Aniline dyes.

The advantages of this method have already been shortly dealt with on page 158 and we will now describe its practical application.

Amongst the better brands of cutch which are placed on the market are to be found both reddish and yellowish kinds, so that the one which is most suitable for any special purpose can be chosen.

In addition to those mentioned above, the so-called prepared cutch is also used for producing cheap and full dark shades.

In all cases the cutch is dissolved in boiling hot water which is then allowed to settle for a short time, after which the solution is poured off from the slimy sediment. For dyeing, concentrated liquors may be used which must last for a long time, or dilute solutions which are sufficiently exhausted after two dips and then run off. This depends upon local conditions, &c., and also upon the depth of shade required.

Cotton yarn is grounded with cutch by boiling for $\frac{1}{2} - \frac{3}{4}$ hour (it is frequently also immersed in the liquid overnight), and for medium and full brown shades a quantity of copper sulphate equal to about $\frac{1}{20}$ of the weight of cutch used is added. It is then wrung out and if reddish shades are required the yarn is worked for about $\frac{1}{2}$ hour in a hot bath containing 2 to 3 lbs. of bichromate of either potash or soda for every 100 lbs. of yarn.

If the shade obtained in this manner is not dark enough, the yarn is again passed through the cutch and bichromate baths.

Fustic is often used along with the cutch for yellowish browns; and for dark shades, logwood extract, the dyeing being carried out in exactly the same manner.

A dull (blackish) brown is obtained by first working the yarn in a bath containing cutch and copper sulphate. This is then followed by a bath to which 5 lbs. of ferrous sulphate has been added, after which the goods are passed into a third bath containing bichromate of potash. In many cases the order of these baths is changed (that is, cutch and copper sulphate, chrome, iron) and the ferrous sulphate is frequently replaced by nitrate of iron.

Cutch is also used for grey fancy shades (where necessary in combination with sumach, fustic, and logwood) and the copper and chrome are replaced by a bath of ferrous sulphate.

When dyeing very light shades, the ferrous sulphate can be added direct to the cutch bath after the yarn has been turned for a few times.

For reddish drab or chocolate brown shades, cutch is used along with sumach without any copper sulphate (where necessary a little fustic is also added).
Cotton Yarn. Basic top on cutch bottom.

This is then followed by a bath of ferrous sulphate and one of bichromate of potash.

The finished cutch ground is generally topped with basic colours, in a fresh lukewarm bath.

On the other hand, if large quantities of basic dyes are to be used, they can be added direct to the cutch bath before the dyeings are fixed with iron or chrome.

The advantage of this method of working is that the colours are readily taken up, but it has the disadvantage that it is difficult to dye to shade.

If, however, the correct shade is not obtained after passing through the chrome or iron liquors, it can be shaded off by giving it a slight topping with basic colours.

The following Aniline dyes are frequently used for topping cutch:

For reddish shades:— *Cerise, Diamond Magenta, Saffranine, Methyl Violet.*

For yellowish shades:— *Auramine, Vesuvine, &c.*

The amount of cutch used has recently decreased to a great extent, as it has been largely replaced by the substantive dyes in those cases where a high degree of fastness is not required, as the latter colours are much easier to work with.

*Kryogene Brown* and *Cotton Black 3B, B, BN* (if necessary shaded with *Pyramine Orange 3G, Oxamine Maroon, Oxamine Red,* and *Cotton Yellow GI*) developed with Nitrosamine solution are much better substitutes for cutch than the ordinary substantive dyes.

The shades obtained in this manner are easy to produce, they are fast to acids and very fast against bleeding into white (if *Oxamine Red, Oxamine Maroon,* and *Cotton Yellow GI* are also used they require an after-treatment with copper sulphate). Such dyeings are comparatively fast to light and the goods dyed in this manner do not feel so hard as those which have been dyed with cutch.

See also page 149.
3. Grounding with substantive dyes with a simultaneous addition of a tannin substance to the dye-bath and then topping with basic dyes (with or without a treatment with antimony salt).

For practical reasons this method has already been described on page 157 (Notes).

4. Dyeing on a mordant of tannin and acetate of alumina.

The method of working is exactly the same as that for producing a mordant of tannin and antimony, with the exception that the antimony bath is replaced by one which contains $2\frac{1}{2}$—$5\frac{1}{2}$ gallons of acetate of alumina 9° Tw. in 180 gallons of water (the amount required for readily working 100 lbs. of yarn). After rinsing dye in the ordinary manner in a lukewarm bath.

As a rule, the shades obtained in this manner are not so fast as those which have been dyed on a mordant of tannin and antimony, but the particular shade of colour obtained is often considerably different.

For example, the shade obtained with *Rhodamine S* on a tannin-alumina mordant is a considerably yellower and at the same time a more beautiful pink than that which is produced on a tannin-antimony mordant.

5. Dyeing on a mordant of stannate of soda and basic alum.

As already mentioned this method is chiefly used for producing specially bright red shades with acid dyes.

In this respect it gives still better results than the ordinary process 6 described on page 162, but the disadvantage is that the yarn which has been dyed in this manner has a hard feel.
The method of working is as follows:—

Work for 1/2 hour in a cold bath of stannate of soda standing at 3° Tw. (this corresponds to a solution of 4 oz. of stannate of soda per gallon) and then leave the yarn immersed in the liquid for several hours. Now wring out and work in a cold bath containing about 20 lbs. of alum and 3 lbs. of calcined soda (or 6 lbs. crystal soda) per 100 gallons of water.

Wring out evenly, enter in to the warm dye-bath (140° F.) and work for 3/4 hour whilst the bath is (of itself) cooling down. Finally wring out well, hydro-extract and dry at a moderate temperature. (It is best to dry the yarn in the open air.)

When preparing the above-mentioned dye-baths not more than 10 times as much water as yarn should be taken when dyeing dark shades.

For 100 lbs. of yarn the first baths are prepared as follows:—

Mordanting bath I:—

180 gallons cold water
45 lbs. sodium stannate.

Mordanting bath II:—

180 gallons cold water
36 lbs. alum
5 1/2 lbs. calcined soda.

Dye-bath:—

100 gallons water
4 lbs. Cotton Scarlet.

The tin solutions can be used for a very long time but they must be kept at 3° Tw. by adding suitable quantities of sodium stannate.

It is advisable to prepare a fresh alum bath each time.

When soda is used in conjunction with alum it must be dissolved separately in hot water. Too large a quantity of water should not be used and the soda solution is added to that which contains alum.

The flocculent or gelatinous precipitate which first forms redissolves on stirring sufficiently.

The dye-liquors are renewed by occasional additions of colour solution and are used again. When producing dark shades, about half the original quantity is required.
6. Dyeing on a mordant of soap and chloride of tin.

This method is used for producing dyeings with Methylene Blue and Soluble Blue in such cases where beauty of shade is of more importance than the fastness.

The method of working is as follows:

Turn the yarn for \( \frac{1}{2} \) hour in a lukewarm bath which contains \( 6\frac{1}{2} - 8 \) oz. of soap in 10 gallons of water, wring out lightly, hydro-extract and then dry.

For 100 lbs. of yarn use about:

\[
7 - 8\frac{3}{4} \text{ lbs. of Marseilles soap} \\
175 \text{ gallons of water.}
\]

The exact amount of soap depends upon the hardness of the water.

If the water is very hard it must first be corrected in the ordinary way by boiling with soda.

Now work the yarn for \( \frac{1}{2} \) hour in a cold bath which contains about 3 oz. of chloride of tin in 10 gallons of water. Let drain, rinse the yarn, hydro-extract, and enter in a lukewarm bath which for the first lot of 100 lbs. of yarn contains

\[
2 - 3 \text{ lbs. of dyestuff} \\
1 - 2 \text{ » of alum} \\
176 \text{ gallons of water.}
\]

Work for \( \frac{1}{2} \) hour in this bath whilst it is (of itself) cooling down, wring out, hydro-extract, and dry without previous rinsing.

The various baths are not exhausted and can be used again after about \( \frac{1}{3} \) of the original amount of mordant and dyestuff has been added.
7. Dyeing on a mordant of Turkey-red oil.

This method is simpler than that in which Turkey-red oil and aluminium acetate are used and it also gives better results.

It is only used for a few basic aniline dyes and more especially for Rhodamine B, G, 6G, Auramine, &c.

The shades produced in this manner possess unsurpassable beauty and are superior to those obtained in any other way.

The necessary amount of the so-called stock solution of Turkey-red oil is prepared by mixing 1 part of Turkey-red oil F with 2 parts of water.

About $2^{1/2} - 3^{1/2}$ gallons of this liquor are placed in one of the mordanting basins which are extensively used for this purpose in Turkey-red dye-houses. (These are made of wood or in a few cases of tin-plated copper. They are constructed so that the upper part is funnel-shaped, affording space for working the yarn, whilst the lower part is contracted to form a small space in which the liquor accumulates.) A handful of dry bleached yarn (2 lbs.) is then entered into this liquid.

A pound of yarn is taken in each hand and turned 5—6 times in the liquid the yarn being passed through the hand.

It is then wrung out on a stick which is fixed above the basin, again passed through the mordant, wrung out once more, after which the liquid in the yarn is evenly distributed and the yarn is shaken out and then laid on a clean dry litter out of the way.

Before mordanting the next handful of yarn the liquor must be brought up to its original level by adding more Turkey-red oil solution to the basin. If care has been taken when wringing out the previous 2 lbs. of yarn not to lose any more of the liquor which is wrung out than is necessary and to run back as much as possible into the mordanting bath, about $1^{3/4}$ pints of new solution will be required.

This is prepared by mixing

3 parts of the stock solution with
1 part of water

and the above-mentioned quantity of this diluted oil mixture No. 1 is poured into the basin.

Now enter the 2nd handful of yarn and work it in exactly the same way as the first, replenish the liquor again with oil mixture (No. 1), mordant the 3rd handful of yarn, and so on, until the whole lot is finished.
The yarn is then completely dried at a moderate temperature and mordanted a second time in Turkey-red oil.

If perfectly level or very full shades are desired, it is necessary to mordant it a third time and, of course, the yarn must be previously dried.

The second and third mordanting operations are carried out in exactly the same manner as the first, with the exception that the mordanting liquors used must be still more dilute than those which are used in the first case.

For the 2nd mordant therefore a mixture (No. II) of

\[ \begin{align*}
3 & \text{ parts stock solution} \\
2 & \text{ » water}
\end{align*} \]

is used.

For the 3rd mordant a mixture (No. III) of

\[ \begin{align*}
1 & \text{ part stock solution} \\
1 & \text{ » water.}
\end{align*} \]

Whereas in the first mordanting operation one requires \(1^{3/4}\) pints of oil mixture I for each handful of yarn to bring the bath up to its original level, not quite \(1^{3/4}\) pints of oil mixture II are required in the second, and rather less than \(1^{1/2}\) pints of oil mixture for the third.

The method of dyeing yarn which has been mordanted with Turkey-red oil in the right way, is to work it for \(3/4\) hour in a cold concentrated bath (containing about 150 gallons for 100 lbs. of yarn) and the colour solution is added in two portions with an interval of 15—20 minutes between each.

For a full shade on 100 lbs. of yarn with Rhodamine B, about \(1^{1/2}\) lbs. of dyestuff will be required, but the bath does not exhaust completely.

Notes.

a) The old method of working on a mordant of Turkey-red oil and acetate of alumina (or aluminium sulphate acetate) is much more complicated than the above process.

The yarn is taken in handfuls and impregnated with a mixture of 1 part Turkey-red oil and 9 of water, after which it is completely dried and then worked in handfuls in acetate of alumina \(7^{1/2}^\circ\) Tw.

After wringing out and evenly distributing the liquid left in the yarn, it must be completely dried.

Each 100 lbs. of yarn which has been mordanted in this manner is then worked for \(1/2\) hour in 150 gallons of water at \(115^\circ\) F. which contain \(17^{1/2}\) lbs.
of whitening. It is then rinsed, hydro-extracted, and without drying treated a second time in the same manner with Turkey-red oil and then with acetate of alumina.

Now pass again through the chalk bath, mordant a third time with Turkey-red oil and acetate of alumina, rinse lightly and dye without chalking or drying.

The dyes obtained in this manner have a harder feel and are not so beautiful as those which are produced by the new method.

The old process is, however, still in use in a few cases, and probably the reason is that the dyers are used to the process when working with Alizarine Red and find it difficult to decide to adopt the very concentrated oil baths which are required in the new process.

A difficulty in working the latter is that the baths do not exhaust regularly, so that the oil accumulates and the rate at which this takes place is different in the second and in the third baths.

The minute details which are given above as to replenishing the liquors are, however, all that is required in this respect, and with careful working good results can always be obtained easily.

It is nevertheless desirable to be able to check the amount of oil which is present in the baths at any time, and as this cannot be done with the hydrometer the following method is made use of:

50 c.c. of the stock solution are placed in a graduated 100 c.c. glass cylinder and carefully mixed with 10 c.c. of concentrated sulphuric acid.

After standing for a short time, a yellowish brown layer of oil separates out above the watery layer and the number of cubic centimetres can be distinctly read off.

The mordanting bath is then tested in exactly the same manner, after a series of 2-lb. lots have been passed through it, and is has been replenished each time.

The same quantity of oil should always be obtained from 50 c.c. of liquid by treating it with sulphuric acid, and this should be equal to the amount obtained in the first case.

If too much oil is obtained water must be added and if too little, undiluted Turkey-red oil must be added until the bath is brought back to its former strength.

It is almost impossible for the liquors to become too dilute, this could only be caused by entering wet yarn or by paying no attention to the above directions.
Cotton Yarn. Dyeing on an oil mordant.

If the liquors become too concentrated, a careful workman will very quickly notice it when wringing out the yarn and then one could use the above-described method of testing whether anything was wrong.

b) The amount of Turkey-red oil necessary for mordanting 100 lbs. of yarn under favourable conditions will be about:

1. As 1st liquor . . . 13 quarts stock solution
2. Additions to 1st mordant 33 » » »
3. » » 2nd » 26 » » »
4. » » 3rd » 18 » » »

Total 90 quarts stock solution.

This amount contains 30 quarts of Turkey-red oil F, which one can therefore consider as being necessary for mordanting one lot. If other lots are mordanted, the 13 quarts 1st liquor which contain 3½ quarts of Turkey-red oil can be deducted.

c) If the shades obtained in this manner with Rhodamine are too blue, the mordant has not been sufficiently strong.

Either the yarn will only have been mordanted once or twice or the quality of the Turkey-red oil employed was poor.

d) Rhodamine gives brighter (yellower) shades when the dye-bath is prepared with hard water than when soft water is used.

e) Fuller shades are obtained with Rhodamine when dyed in a cold bath than when dyed in a hot bath.

f) Streaky dyeings may be caused by uneven wringing out or hydro-extracting, by drying badly or by omitting the third mordanting process.

g) Spots may be formed on the yarn by taking hold of it with wet fingers, or by laying it in wet hydro-extractors.
Production of dyes on the fibre.

Under this heading are included two different methods of developing, viz:—

A. The production of dyestuffs from substances which possess no dyeing properties themselves but which can be changed into dyestuffs by a chemical reaction taking place on the fibre.

B. The production of new products by further developing dyestuffs so as to change their shade and properties.

These two processes are identical in chemical nature in those cases where they depend upon the production of a diazo-compound and not on an oxidising process as is the case with Aniline Black. On the other hand, there are several practical differences, depending in most cases on the different behaviour of the substances in question towards the fibre.

In group A, for example, (Nitrosamine Red, &c.) the fibre is impregnated with a substance (Beta-Naphthol) which has very little affinity for the fibre, and its fixation is therefore accompanied by certain difficulties.

The dyestuff which is afterwards formed from it has no real affinity for the fibre but is formed and fixed in the material as an insoluble precipitate.

In group B, on the other hand, (substantive dyes developed on the fibre) the material is dyed in the ordinary way and then a new colour is produced on the fibre from the one which was first used.

Of course, the technical difficulties are generally less in such cases, as one is working with a ground which is fully fixed.
Cotton Yarn. Dyeing with Nitrosamine Red.

It would be of little use to give a full description of the technical details involved in developing the dyestuffs of group A, as they vary continually on account of the endeavours that are being made to improve them. Special directions are therefore issued for these from time to time.

The question is therefore treated in a general manner and as a typical example we will consider the above-mentioned Nitrosamine Red which was first placed by us on the market.

A. Production of Nitrosamine Red on the fibre.

When producing bright shades the ground colour of the raw material always plays a very important part, and where possible bleached cotton should be used.

The above holds good in this case also, but the question of price and other reasons often prevent the yarn from being bleached. Under such circumstances it should at least be thoroughly boiled out with an addition of soda, then rinsed and dried.

It is now mordanted in the same manner as when dyeing with Rhodamine on a Turkey-red oil mordant. In this case, however, a concentrated liquid is used which contains the sodium compound of Beta-Naphthol as the active constituent. (This is prepared by dissolving commercial powdered Beta-Naphthol in a dilute solution of caustic soda.)

The hands are protected from the corrosive action of the caustic soda by wearing India-rubber gloves.

Besides the naphthol sodium solution, a considerable quantity of Turkey-red oil is added to the bath; or castor oil soap, &c. may be used for the same purpose.

These substances, however, play no part in the chemical reaction by which the red is produced and one must conclude that their effect is a mechanical one.

After the yarn has been impregnated with this solution, it is wrung out twice fairly tightly, but regularly, then hydro-extracted, and dried at a temperature which should not exceed 140° F.

It is best to reserve a special room for this purpose as the drying should take place quickly excluding bright light, otherwise the yarn is liable to become brownish, and this would have an unfavourable influence on the beauty of the shade.
Cotton Yarn. Dyeing with Nitrosamine Red.

The yarn should not be roughly moved whilst drying as it would tend to bring off the sodium naphtholate. One must also avoid touching it with wet fingers as this would dissolve the preparation at those places with which the moisture came into contact.

After the yarn has been completely dried and cooled down sufficiently it is developed in handfuls with the Nitrosamine Red solution, i.e., it is dyed, the mechanical details of the process being the same as those of the previous preparation of the yarn.

The dye-liquor is prepared by simply diluting down the Nitrosamine Red and changing it into the diazo-compound of paranitraniline by adding acid.

In this manner the same substance is obtained as is produced by diazotising paranitraniline with sodium nitrite and hydrochloric acid, but Nitrosamine Red is much more reliable to work with.

A fairly attentive workman will therefore always obtain the same results with the latter product, whereas trouble is always liable to occur when working with paranitraniline as it is more difficult to convert into the diazo-compound.

The various additions which are made to the Nitrosamine solution (see our special recipes, one of which is to be found on page 488 and following pages) are intended to render the diazo-compound more stable, or to increase the rate of its combination with the sodium compound of Beta-Naphthol.

A study of the whole of the Nitrosamine Red process and of all processes which depend upon similar principles renders it clear, that the only ground which is open to experiment on the part of the practical dyer is, to try to improve the technical details in carrying out the operations. Any one-sided alteration of the proportions stated in our special recipes must be strictly avoided, or the unalterable conditions necessary for the chemical reactions will no longer obtain.
A. Aniline Black.

Although the method of producing Aniline Black differs in principle from the above-described process, still it can also be classed under the heading of producing colours on the fibre itself.

It is not our intention to give a full description of the various methods here, as they all depend upon the action of oxidising agents on aniline salt or aniline oil dissolved in acid.

There is quite a large number of these methods but very few of them differ from each other from a chemical point of view, but rather in the practical details of the processes which offer, or are supposed to offer, more or less advantage with regard to the beauty and fastness of shade, or in the matter of price.

There are practically two kinds of Aniline Black:—

1. Black produced in one bath (warm method).
2. » » » two baths (cold method).

The production of the former is simple and easy, but the shade is not so beautiful or so fast to rubbing and acids as the shade of the latter.

1. Aniline Black produced in one bath (warm method).

The following recipe may be taken as an example. It gives good results and may therefore be of use in some cases.

For 50 lbs. of cotton yarn prepare a bath with

75 gallons water
9 lbs. bichromate of potash or bichromate of soda
2 » sulphuric acid 168° Tw.
3 » hydrochloric acid 32° Tw. 30°/o.

After stirring well add
5 lbs. Aniline Salt O (B. A. S. F.) or
3 » 8½ oz. Aniline Oil (B. A. S. F.) +
4 » 10 » hydrochloric acid 32° Tw.

and stir until dissolved.
Work the yarn in this liquid cold for 1 1/2 hours and then for 1/2 hour at 120° F. and a further 1/2 hour at 175° F. Finally rinse thoroughly, and, in order to give the yarn a soft feel, work for 1 hour at 120—175° F. in a bath which contains

- 5 lbs. of soap
- 1 1/2 oz. of olive oil.

2. Aniline Black produced in two baths (cold method).

The methods for producing this black have been worked out and perfected to such an extent by a few large dyeing establishments that it is scarcely possible for a dyer who only works on a small scale or only requires to dye now and then, to produce shades which are up to standard in point of beauty and other properties and to compete in price.

We cannot therefore claim, that the following process, although it is taken from actual manufacturing practice, will give the best results that it is possible to obtain.

We consider it advisable, however, to mention it here, as it gives a black which is fully good enough for many purposes.

For 50 lbs. of cotton yarn

prepare the bath with

- 60 lbs. of Aniline salt O (B. A. S. F.)
- 20 » » chlorate of potash
- 7 1/2 » » copper sulphate
- 1 1/2 gallons of aluminium acetate 15° Tw.
- 2 1/2 lbs. of starch
- 55 gallons of water.

The starch is previously boiled with 2 1/4 gallons of water and then added to the bath which should now stand at 7—8° Tw.

The yarn is worked for 1 1/2 hour at the ordinary temperature in this solution, then wrung out and hydro-extracted. It is now allowed to hang moist for 12 hours at a temperature of exactly 86° F., after which it is oxidised for 1/2 hour at 160° F. in a solution of

- 2 lbs. of bichromate of potash (or bichromate of soda) in
- 80 gallons of water.
If a very deep black is required, more concentrated baths than those described above must be used. For many purposes, however, it is preferable to previously ground the yarn with a suitable substantive black (e.g., Violet Black). This method is considerably cheaper than producing a very full pure Aniline black.

In both cases the yarn after being chromed is rinsed and then worked for 1 hour at 130° F. in a fresh bath which contains

5 lbs. of soda ash dissolved in
80 gallons of water.

After this it is wrung out and worked for 1/2 hour at 130° F. in a hot solution of

5 lbs. of Marseilles soap and
11 3/4 oz. of olive oil in
80 gallons of water.

If the shade obtained is not sufficiently blue, the temperature of this bath should be raised to 175° F.

Finally wring out and hydro-extract.

For the second and following lots the old bath is replenished with

7 1/2 lbs. of Aniline salt O (B. A. S. F.)
(1/8 of the original amount)
2 1/2 » » potassium chlorate
2 1/2 » » copper sulphate
1/2 gallon of acetate of alumina 15° Tw.
13 oz. of starch

and water is added until the bath stands at 7—8° Tw.

If the bath is kept in proper condition it can be used for a very long time.

Notes.

If in the above process the Aniline salt is replaced by Aniline oil, then in place of 60 lbs. of the former one must use

42 1/2 lbs. of Aniline oil
56 » » hydrochloric acid 32° Tw.

Instead of 55 gallons of water only 51 gallons should be added or the liquors would become too dilute.
Cotton Yarn. Development of substantive dyes on the fibre.

The chief difficulty in dyeing the two-bath Aniline Black is to carry out the moist hanging correctly. If the yarn is left hanging too long, if the air is too dry, or if the temperature is too high, the fibres will be rotted, whereas if the conditions are reversed the black will not be developed sufficiently. From the nature of the operation it is quite clear that success depends to a very great extent on the special arrangement of the plant.

B. The development of substantive dyes on the fibre.

A series of substantive dyes are chemically constituted in such a manner that they can be diazotised on the fibre and then changed into a dyestuff of a different nature by bringing them into contact with certain substances which are technically known as developers.

The effect of this is not so much the production of special shades which cannot be obtained in any other manner as to increase the fastness to washing which in most cases is very considerable, especially with regard to bleeding into white.

In this manner one of the chief drawbacks of the substantive dyes is removed and for this reason this rather complicated process has been very extensively taken up. In many cases the vegetable dyes have been replaced in cotton dyeing by such developed colours. This method of dyeing is carried out in wooden vats which are similar to those in general use in cotton dye-houses.

For the smooth execution of the process a sufficient number of such vats are required and these should always be reserved for the same purpose.

One requires at least:

- A vat for diazotising the previously dyed goods
- » » » rinsing in acidified water
- » » » developing.

The yarn is prepared and grounded with substantive dyes as described on page 143 and following pages.

As a rule it is advisable to rinse the shaded goods slightly before diazotising, but this can frequently be omitted.
Of our products, the following are specially adapted for diazotising and developing on the fibre: —


1. Diazotising on the fibre.

The nitrous acid required for this purpose is prepared by simply treating sodium nitrite with hydrochloric — or sulphuric — acid. The use of the latter is often avoided on account of the care which must be taken when mixing it with water because of the intense development of heat. On the other hand, however, it is cheaper to use.

The most important rule in diazotising is to use perfectly cold solutions.

The baths can be used several times within a short period if they are replenished each time and if the temperature of the air and water is favourable, i.e., if the liquors remain sufficiently cool.

The amount of nitrite required depends upon the intensity of the shade of the substantive ground. A table giving the necessary information is to be found on page 481.

The diazotising process is carried out as follows: —

A quantity of cold water which is sufficient to work the yarn in is run into the vat, i.e., about 175—200 gallons for 100 lbs. of yarn. The nitrite is dissolved in a little water and then poured in and mixed, and the acid is added just before the vat is required.

If this vat is in order, it should smell slightly of nitrous acid, and a strip of white pasteboard which has been dipped for a moment into a 10 % solution of potassium iodide and then partially dried between blotting paper should immediately turn blue if dipped into it.

The yarn is turned 5—6 times in this bath, taken out, let drain a little and then rinsed quickly in a cold bath which contains 2 1/2 — 3 pints of hydrochloric acid in 175—200 gallons of water. It is again let drain for a short time and then worked in the developing bath which has been prepared in the meantime.

As little time as possible should be lost when working the diazotising process and the yarn should not be left lying longer than is absolutely necessary for the greater part of the liquid to drain from it (either before or after rinsing) especially if the weather is warm.
Great care must also be taken to protect the diazotised yarn from the direct 
rays of the sun.

As a rule the temperature of the nitrite baths should not be allowed to rise 
above 60° F., especially when working in old liquors for some time.

If ice can be obtained at a low price it is a convenient means of increasing 
the stability of the nitrite baths.

2. Developing of diazotised dyeings.

The various developers can be divided into several groups according to their 
method of application.

a) Those which require an addition of alkali to bring them into solution and 
to help them to combine with the diazotised colour. These are:—Alpha-Naphthol, 
Beta-Naphthol, Resorcin, Phenol. (Oxamine Developer M which is placed in 
group b also gives better results when soda is used with it, but this is not 
absolutely necessary.)

b) Those which can be used without any further addition. These are:—bleaching 
powder solution, Oxamine Developer M (it is better to use soda). Alpha-naphthylamine hydrochloride, Oxamine Developer B, R. (It is advisable to 
add a little hydrochloric acid with the latter.)

If it is necessary to use products of groups a and b together, they should 
be dissolved separately and added to the bath just before use.

In all cases the solution of the developers is poured into a quantity of 
water which is sufficient to work the yarn in, viz:—175—200 gallons per 
100 lbs. of yarn and the latter is turned in this for 1/2 hour in the cold.

It is then rinsed, hydro-extracted, and dried.

c) A third method of developing might also be mentioned here. It consists of 
changing the diazotised colour on the fibre into a new product by treating it 
with a warm soda solution. (In the case of silk a warm soap solution is used.)

The yarn is taken from the diazotising bath, let drain, then turned 5—6 
times in a bath which contains 2—4 1/2 lbs. of soda per 100 lbs. of yarn, 
at a temperature of 100—120° F. It is then well washed.
3. Developing of direct dyeings with diazotised developers.

This method of developing differs from that described under I, in which case the substantive dyes are diazotised and developed on the fibre. In this process the yarn is slightly rinsed as it comes from the dye-bath and then entered into a bath which contains the diazotised developer.

The following substantive dyes are used for this purpose:—Oxamine Blue BG, Cotton Black 3B, B, BN, Pyramine Orange 3G, Oxamine Red, Oxamine Maroon, and to a lesser extent also Cotton Yellow G and GI. As developer, Nitrosamine solution, i.e., Nitrosamine Red paste which has been treated with hydrochloric acid, is used.

The method of working is practically the same as that which has previously been described. The preparation of the Nitrosamine solution used for developing is very simple. For example, to develop the ground shade produced by dyeing 100 lbs. of yarn with 2/4 lbs. of Cotton Black 3B take 3 lbs. of Nitrosamine Red paste and stir it into 4 1/2—5 1/2 gallons of cold water and then add slowly 1 pint of ordinary hydrochloric acid 32° Tw.

This is let stand for 1/2 hour and the cloudy solution is then poured without filtering into the water in which the yarn has to be developed (about 165 gallons).

Shortly before use, a solution of 1 1/4 lbs. of sodium acetate dissolved in 1/2 — 3/4 gallon of water is added to the vat. A cheaper substitute for the above is obtained by gradually stirring 1/2 lb. of calcined soda into 1 lb. 15 oz. of acetic acid 9° Tw. (30°/0).

After the above solution has been added to the vat the yarn is entered and turned for 1/2 hour, and then rinsed, hydro-extracted, &c.

If a topping of basic colours is required, they can generally be added to the Nitrosamine bath. In this case the yarn is turned 5—6 times in the Nitrosamine solution and then taken out. The basic colours are then added and the dyeing is continued and finished cold.

Notes.

1. The quantity of Nitrosamine must be correspondingly increased or decreased for shades which require more or less than 2 1/4 lbs. of dyestuff for grounding.

   The same holds good for the other substances used.

   Of course, the proportion of the various reagents to each other must not be altered.

2. If the shades require to be as fast as possible, they are treated in some cases for 1/4 hour with a solution of 1 lb. copper sulphate in 165 gallons of water at 160° F.

   If desired the copper sulphate can be added to the Nitrosamine bath, but in this case the dyeings obtained are not quite so fast to washing.
Mistakes which may happen when diazotising and developing by any method.

The following are the mistakes which are most frequently made:

1. Streaks in the developed shades.

When this difficulty is encountered one should first make certain that no mistakes have been made during the dyeing process, for it would be impossible to produce developed dyeings which are even from an uneven ground.

If there is nothing wrong with the ground of substantive colours such streaks may be due to mistakes which have been made in the methods of working described under 1 and 3, pages 191 and 193, viz., in method 1 the colour may not have been diazotised sufficiently, due to using nitrite baths which have not been replenished properly or which have decomposed; or, in method 3, to the Nitrosamine Red not having been treated sufficiently with acid.

The quickest manner of clearing up such a difficulty is to use a nitrite bath freshly prepared with all possible care.

If the dyeings still come up streaky the probable cause (in method 1) will be that the acid rinsing after diazotising has been omitted to save labour. It might be mentioned here that this bath is the greatest help towards preventing such streaks.

Using too little of the developer is also another source of trouble. It frequently happens that a sufficient amount of developer is present, but (in the case of 2a and 2c) it is partially thrown out of action due to the introduction of too much liquor with the yarn from the acid rinsing bath, which partially neutralises the alkali of the developing bath and thus hinders the formation of the colour.

If there is reason to believe that this is the cause of the unevenness, more caustic soda or calcined soda than is stated in the tables should be added for the next lot.

This can be done without causing any injury, as a moderate excess is of no consequence and is simply avoided in the recipes for the sake of cheapness.

2. Bleeding into white.

The shades obtained by diazotising and developing substantive dyes on the fibre bleed slightly into white if very severely washed. The best dyes of this class, however, bleed so little that it is of no practical importance in most cases.
If, however, dyeings whose behaviour in this respect is known bleed more than usual, the same mistakes will have been made which produce streaks.

In most cases it will be due to part of the substantive ground not having combined with the developer. In such cases it will generally be noticed that the shade of the colour which has bled into the white is not that of the developed dye but of the undeveloped substantive ground.

The remedy is the same as that which is made use of when streaky dyeings are obtained.

The shades produced with diazotised developers, e.g., substantive dyeings treated with Nitrosamine solution (see 3, page 193) are, if correctly dyed, faster against bleeding into white than such as are produced according to process 2a—c. This is especially the case if they are afterwards treated with copper sulphate. If such dyeings do bleed, then the Nitrosamine solution has not been correctly prepared, or too little of it has been used, or the yarn has not been worked long enough in this solution and the treatment with copper sulphate has taken place at too low a temperature.

3. Poor fastness to light.

It is also to be mentioned that such faulty working not only decreases the fastness to washing but with several developed colours the fastness to light is also impaired.

This may further be caused by intentionally or unintentionally using a smaller percentage of developer than prescribed.

4. Bleeding into white after the goods have been stored.

This trouble is sometimes encountered in the case of developed dyeings and is due to an excess of developer subliming into the white. The oxidising action of the air then causes the white to assume a reddish or brown tint which thus shows up the mistake.

Oxamine Developer B is especially liable to give rise to this difficulty.

This can be prevented by carefully diazotising and developing and finally subjecting the yarn to a hot soaping.
The following are the substances which are chiefly used at the present time for developing those of our colours which have been mentioned above:—

Beta-Naphthol
Alpha-Naphthol
Oxamine Developer B, R, M
Nitrosamine solution (prepared from Nitrosamine Red paste).

The following are also used but to a less extent:—

Resorcin
Phenol
Soda
Alpha-naphthylamine hydrochloride
Bleaching powder or Hypochlorite of soda solution.

The following shades are obtained with these developers:—

Sulphine A and N diazotised and developed with Beta-Naphthol give a bright red.
Sulphine A and N diazotised and developed with Alpha-Naphthol give a brownish red. (In darker shades it approaches a claret brown.)

Sulphine A and N diazotised and developed with Oxamine Developer M give red-brown.
Sulphine A and N diazotised and developed with Oxamine Developer B give a bluish red.
Sulphine A and N diazotised and developed with a soda solution give a full yellow which is not very full overhand.
Sulphine A and N diazotised and developed with a solution of bleaching powder give very fast golden yellow shades.

Oxamine Violet diazotised and developed with Beta-Naphthol gives a navy blue (medium).
Oxamine Violet diazotised and developed with Alpha-Naphthol gives a navy blue (reddish).
Oxamine Violet diazotised and developed with Oxamine Developer B gives a navy blue (greenish).
Oxamine Violet diazotised and developed with Oxamine Developer R gives a navy blue (medium).
Oxamine Blue RRR with corresponding developers always gives clearer shades which are, however, not so full as those obtained with Oxamine Violet.
Oxamine Blue BG diazotised and developed with Oxamine Developer R gives a full violet.
Oxamine Black N, A diazotised and developed with Oxamine Developer M gives a black.
Oxamine Black N, A diazotised and developed with Beta-Naphthol gives a black blue.
Cotton Black 3 B, B, BN developed with Nitrosamine solution give blacks or dark browns.
Oxamine Blue BG developed with Nitrosamine solution gives a full green.
Oxamine Red developed with Nitrosamine solution gives a full claret.
Oxamine Maroon developed with Nitrosamine solution gives a dark red-brown.
Cotton Yellow G and GI developed with Nitrosamine solution give a full yellow.
Pyramine Orange 3 G developed with Nitrosamine solution gives a brown-orange.
After-treatment of various kinds of dyeings

with certain chemical substances in order to increase their fastness or to produce an alteration in shade.

The most important methods are:

1. An after-treatment with tannin substances.
2. Impregnating with substances which render the materials water-proof.
3. Treatment with copper salts.
4. Treatment with chrome compounds.
5. Subjecting them to steaming.
6. Treatment with chlorine or hypochlorite salts.

Below we give some information regarding the working of these processes.

After-treatment with tannin substances.

Very many shades, even those which have been produced with dyestuffs of a basic nature on a mordant of the correct strength, can be rendered faster to rubbing, sizing, washing, &c., by an after-treatment with a tannin substance.

This is generally carried out by adding \(3/4\) to \(1\frac{1}{2}\) oz. of tannic acid to every 10 gallons of water in the rinsing bath.

Of course a decoction of sumach or similar substances could be used in place of tannic acid.

When carried out in this manner this operation is quite a simple matter. In many cases, however, a considerable alteration in shade takes place.

If dyeings which have been treated in the above manner are subjected to a further treatment with antimony salt they are rendered still faster.
Cotton Yarn. After-treatment of certain shades in order to increase their fastness.

Rendering the goods water-proof.

To describe the many methods which are in use for this purpose would require too much space here. In almost all cases it is piece-goods which are subjected to this process.

One of the most usual is the treatment with alum and soap.

The dyed goods are impregnated with a solution of 1 lb. of alum in 10 gallons of water. They are then squeezed out, dried well and passed through a solution of 8 oz. of soap in 10 gallons of water, after which they are again squeezed out and dried.

The whole process can then be repeated if desired.

Other methods depend upon the use of wax, stearine, tallow, &c.

Heavy materials such as are used for tents, for example, are passed through a mixture which is produced by boiling wax and stearine with water. The goods are then passed through a hot calendering machine which brings about more perfect penetration.

Another method which has recently been extensively used is to work with formaldehyde in conjunction with glue, gelatine, and similar substances.

After-treatment with copper salts. (See also page 148.)

This method is coming more and more into use for such colours as are rendered considerably faster to light and washing by an after-treatment with copper sulphate. The method is a very simple one and generally consists of treating the dyeings for only \( \frac{1}{4} - \frac{1}{2} \) hour in a cold—or in many cases also warm—solution of 3—4 lbs. of copper sulphate for every 100 lbs. of yarn.

The goods are finally rinsed.

A hot solution of copper sulphate acts more quickly and powerfully than a cold solution.

In many cases the shade is more or less changed, or at least the tone becomes duller. If colours which are developed on the fibre require to be subjected to such a treatment, the copper vitriol is frequently added to the cold diazotising bath in order to spare an extra bath.
After-treatment with chromium compounds. (See also page 149.)

The after-chroming of dyeings produces a marked effect in very few cases (with the exception of the oxidation of Aniline Black and Anthraquinone Black with bichromate of potash).

In those cases where this treatment is required the goods are worked in a solution which contains $2\%$ of bichromate of potash on the weight of the goods, in the same manner as when copper salts are used.

Copper sulphate and bichromate of potash are frequently used together, and acetic acid is also added to increase the action of the latter, e.g., $3\%$ copper sulphate, $2\%$ bichromate of potash, $\frac{1}{2}^\circ\%$ acetic acid $9^0$ Tw.

Steaming under pressure.

If the goods are steamed under slight pressure in the manner in which it is carried out in calico printing, either with or without access of air, certain alterations of the shade and fastness result with some colours.

Both dyed yarn and piece-goods can be treated in this manner. Indoine Blue dyed on a tannin mordant is a very good example of a colour which is improved by this treatment as it is rendered faster to washing and sizing.

Auramine, Saffranine, and Methylene Blue also become faster if treated in this manner. (The first of these products, however, loses somewhat in strength.)

After-treatment with chlorine compounds (after-chloring).

This method is, of course, only used to a limited extent. In several dye-houses vat-dyed (indigo) embroidery yarn is treated in this manner as it is supposed to render it faster for its special purpose.

As a matter of fact this process cannot render the indigo itself faster, it can only bleach away a part of the indigo from the surface of the yarn. This may certainly make the dyeings somewhat faster to rubbing, &c.

Chlorine has an interesting effect on the yellow shades produced with Sulphine, and one which is actually utilised in practical work. The shade becomes very much redder and the fastness is improved to a very great extent.
Cotton Piece-Dyeing.

The principles of the methods used for dyeing cotton piece-goods are the same as those for cotton yarn.

Of course, alterations must be made in the details of manipulation and in the apparatus used.

Apparatus for dyeing Piece-Goods.

Piece-goods may be dyed as follows:
1. In a vat similar to those used for woollen goods.
2. In the jigger.
3. In the Foulard Machine.

In addition to these the continuous dyeing machines and the dipping vats are used for special purposes (indigo).

In the first case the pieces are passed over a series of rollers similar to those used for bleaching, and in the latter case they are hung on to cross frames and the pieces are dyed by sinking these into the vat.

1. Dyeing in the vat. (Working on the winch, dyeing in the rope form.)

As a rule, this method is only used for goods which are too broad or loosely woven to be dyed in the jigger.

It is also used in those dye-houses where only a few cotton pieces have to be dyed from time to time. In such cases the jigger is often too large to be used.
Cotton Piece-Goods. Dyeing in the vat and in the jigger.

The conditions of working according to this method are most similar to those of cotton yarn dyeing, as here also a large quantity of water is used in proportion to the weight of the goods.

When producing very dark shades one must therefore use as little water as possible so that the baths will exhaust sufficiently.

The vat is in so much more suitable for dyeing light shades than the jigger as the colours generally turn out clearer and more beautiful. It is also easier to produce level dyeings in the vat as the liquors are more dilute.

If the general rules given on page 89 (dyeing of woollen piece-goods) regarding the treatment of the goods when dyeing are kept in view, and if attention is paid to the principles of dyeing cotton yarn with basic or substantive dyes, it is not difficult to obtain good results.

In this place it is not necessary to repeat what has been previously said on the subject.

2. Dyeing in the jigger.

In the course of time this apparatus has gradually been improved and it is now the one which is most extensively used for cotton piece-dyeing.

It consists of a wooden vat which is expanded above and narrow below and it holds comparatively a very small quantity of dye-liquor.

Above this vat is placed a system of rollers, two being essential. On one of them the piece to be dyed is smoothly rolled, the cloth is then caused to pass in the stretched condition from this under or over two or three rollers which are placed in the liquid itself. It is then wound on to the second of the above-mentioned rollers. These rollers are turned by machinery. The motion of the jigger is now reversed so that the pieces are wound off from the second roller on to the first, and so on.

Recently constructed jiggers frequently contain other rollers which rest upon the two principle ones; the former are placed in a slot so that they can move upwards. The pieces run between these two rollers, which act as squeezers, and they are then wound on to the upper one, or they are run between these two and then wound on to a third movable roller which lies to one side on a steep inclined plane. As this rests upon the first roller it moves with it.

In addition to this all jiggers are fitted with a brake, which prevents the roller from which the piece is being wound off from rotating too quickly, and in this manner the piece is always kept in a state of tension.

Most jiggers are built so that 10—12 pieces sewn end to end, i.e., about 550—650 yards, can be rolled up and dyed in them.

If the vat of the jigger is constructed correctly, i.e., if it is contracted as much as possible below, only about 33—44 gallons of water will be required for the above-mentioned quantity of goods, so that a saving of steam, mordant, and quantity of dyestuff required is effected.

A jigger should generally run at such a speed that a full minute is required for each piece to pass through the dye-bath. The above-mentioned quantity of goods therefore requires about 10—12 minutes.

General notes regarding the working in a jigger.

1. As a rule it is quite easy to decide whether a certain kind of cloth can be dyed on the jigger or not, but if necessary this must be determined by experiment.

   It is essential that the material in question should not have been previously pulled out of shape by some unsuitable treatment so that it will not run evenly on to the rollers. In addition to this the lists must not be too thick, which would cause them to form high ridges when the piece is wound on to the rollers.

   Pieces in which the warp is tightly spun and the weft only loosely spun are not adapted for dyeing on the jigger as they shrink irregularly, especially when dyed in hot liquors.

   The above-mentioned defects are, however, seldom met with in cotton piece-goods and occur more often in linen and half-linen pieces.

   Very loosely woven thin materials (gauze, &c.) cannot be dyed in the jigger, as the fairly severe tension would cause them to stretch irregularly.

2. If one has to constantly dye or top large quantities of cloth with basic colours it is absolutely necessary to use a system of jiggers, and the same jigger should always be reserved for one special purpose.
For example,—

Jigger No. I is reserved for the tannin mordant
» » II » » » antimony or iron mordant
» » III » » » dyeing.

In No. I or between No. I and II it is advisable to have an arrangement for squeezing out the pieces before they run into jigger No. II.

A rinsing arrangement with a squeezing roller should be placed between No. II and III. (If necessary an extra jigger can be used for this purpose.)

In order to render it easier to transfer the goods from one apparatus to the other, rollers are suitably arranged above the jiggers and over these the pieces are passed.

The above-mentioned system of jiggers is not necessary when working with substantive dyes, but still when stock shades are dyed it is advisable to reserve a jigger for each, as the baths do not exhaust, especially when dyeing dark shades, and after being suitably replenished can be used for further lots.

If substantive dyes are used which are to be developed on the fibre, then a series of jiggers must be used, e.g.,

Jigger I for dyeing
» II » diazotising
» III » acid rinsing
» IV » developing.

In cases where large quantities of developed colours are continually produced, it is best to replace jiggers II, III, and IV by large rectangular wooden vats which contain a system of wooden rollers over which the pieces run in 10—12 folds.

Squeezing rollers are placed between each vat with an arrangement for running back the liquors which are squeezed out.

Wooden tubs are placed at the side of each system of rollers from which the exhausted diazotising and developing solutions continually flow.

The pieces must be protected from the direct rays of the sun (see page 190 and following pages).

3. As already mentioned very small quantities of liquors are used when working with the jigger and this is a very important advantage. Of course, care must be taken to prevent the quantity of liquor in the vat from increasing too much during the heating up of the vat and this is best prevented by using closed steam pipes. In many cases, however, this arrangement can not be made, then at least the water which is carried over with the steam should be removed as completely as possible before the steam is allowed to enter the vat (see page 134).
4. The hot liquors must not be allowed to boil up too vigorously as this can easily give rise to creases.

5. If the jiggers are lined with copper plates, or if the whole basin consists of cast iron, light mordant colours must not be dyed in them (on account of the dulling action of the metal on the tannin) or again, with several substantive dyes such jiggers cannot be used as they are very sensitive to copper, &c.

6. Cotton pieces are either boiled out under pressure in boilers, or, in small dye-houses, in the jigger itself. If soda is used for this purpose the goods must be carefully washed before being mordanted. (See page 135.)

Typical method of working when dyeing with basic Aniline colours on a tannin-antimony or a tannin-iron mordant.

The goods (10—12 pieces = 550—660 yards) are stitched evenly end to end and several yards of cloth of the same width are stitched on to the end of the long band so produced.

They are then wound evenly on to the jigger roller, care being taken to avoid creases.

If the pieces have just been bleached or boiled out they can be mordanted immediately. If this is not the case they are run for 1 hour through boiling water to which, if necessary, a little soda has been added. They are then rinsed by passing several times through fresh water.

Mordanting—The hot solution or decoction of the tannin substance is poured into the apparatus, and then diluted to about 33 gallons, or at least until the lower rollers are half immersed in the liquor. Now raise to the boil and let the goods pass through. After boiling for \( \frac{1}{4} \)—\( \frac{1}{2} \) hour turn off steam and mordant until the liquors have cooled down to 100—120° F. As a rule this requires about one hour, so that the pieces will have passed 8—10 times through the liquid if they run at the speed previously mentioned.

The pieces are then squeezed out, or, if there is no arrangement for doing this, they are wound on to the rollers and let drain for a short time during which period the roller should be turned occasionally. After this the pieces are worked for \( \frac{1}{2} \) hour in a cold antimony or iron bath, i.e., the pieces are passed 3—4 times through.

After washing in a sufficient quantity of water which runs in continuously above, and out below, the goods are passed into the jigger for dyeing.
Dyeing.—Many shades require an addition of alum, aluminium sulphate or acetic acid in order that the dyeing may be level and penetrate the material sufficiently. (See note on page 172 and note 4, page 483). The solution of these substances alone should in such cases be poured first into the dye-vat into a quantity of water which is rather less than is required for dyeing the pieces in (about 22—27½ gallons).

The pieces are now passed once or twice through this liquid until thoroughly wetted with it. In the meantime the colour solution is prepared by pouring 11—13 gallons of boiling water over the necessary quantity of dyestuff. This is best carried out in a small wooden tub placed in a suitable position near to the jigger, so that the colour solution can be ladled out into the latter without loss.

From 1—3 ladlefuls of this solution are poured into the jigger through a small fine sieve and mixed up well with the water. The pieces are then passed once through, a similar quantity of colour solution is added and so on until the whole of it has been used up. The colour solution is added each time the direction in which the pieces run is changed.

The amount of colour solution to be added at a time (1—3 1/4 gallons) depends upon the nature of the shade, the kind of material, and upon whether the colours used dye evenly or not.

After the last lot of colour solution has been added the temperature is raised to 100—120° F., in a few cases to 160° F. or higher, (see note f, page 173) and the dyeing is completed.

The time required to finish a lot which requires to be completely penetrated and to be dyed on a strong mordant varies from 4 1/2—7 hours.

Notes.

1. Goods which have been mordanted with tannic acid, when squeezed out or sufficiently drained must be immediately passed through an antimony or iron bath.

If for some reason or other this is not possible, the pieces should be completely rolled on to one of the rollers of the jigger, fastened tight and the roller left turning until they can be passed through the antimony bath.

The goods must not be allowed to remain at rest or the tannin liquors settle down into the lower part of the roll of cloth and cause irregular mordanting.

On the other hand, after the goods have been passed through the antimony or iron mordant and rinsed they can be rolled up and left standing as the tannic acid is then completely fixed in the material.

2. When delicate shades are being dyed on the jigger care must of course be taken when pouring in colour solution to avoid splashing the pieces with the concentrated solution.
3. If dark lists are formed when dyeing pieces they will in most cases be caused by the second pair of squeezing rollers, which are furnished with many jiggers of recent design. These increase considerably the tendency of the liquid to accumulate at the edges when the pieces are wound on to the rollers. If more liquor is present at the exterior of the roll the pieces will often dye darker there.

In most cases the difficulty can be obviated by taking away the pressure rollers.

If an improvement is not effected in this manner, then in all probability the jigger is badly constructed, and in most cases the mistake is that the steam is not introduced correctly.

4. If the ends of the pieces at the beginning and end of the whole band remain too light, the difficulty can only be overcome by increasing the length of the cloths stitched on in these places.

5. With regard to the other difficulties that are liable to be encountered when dyeing with basic colours, see page 172 and following pages.

Example.

To dye a medium blue shade with Indoine Blue on a tannin mordant.

5 pieces of raw muslin weighing about 123 lbs., length 460 yards.

Boiling-out.—Pass the pieces 6—8 times through a boiling solution of 3 1/4 lbs. calcined soda in about 44 gallons of water.

Rinsing.—Pass three times through each of two rinsing baths, if possible using running water.

Mordanting.—Pass the goods twice at the boil and six times whilst cooling down through 22 gallons of water containing a decoction of 16 1/2 lbs. sumach leaves.

Squeezing-out.—Wind on to the upper squeezing roller or pass through the squeezing rollers of the rinsing machine.

Antimony salt bath.—Pass 4 times through a fresh cold bath containing 1 lb. 10 1/2 oz. of antimony salt.

Rinsing bath.—Pass 2—3 times through about 44 gallons of water.

Dyeing.—Pass the goods once through a fresh solution of 1 1/2—2 1/4 lbs. of alum or half this quantity of sulphate of alumina in 22 gallons of cold water.

Now dissolve 1 1/2 lbs. of Indoine Blue BB powder in about 7—9 gallons of boiling water. Add half of this solution to the bath and pass the goods once through it. Now add the other half, pass the goods once again through it, warm the bath up to 100° F. and pass through twice. Warm up to 160° F. and pass through again twice, raise to the boil, pass through twice and again twice whilst boiling up with steam, finally pass once or twice without steam.

Rinsing.—Pass twice through a fresh cold rinsing bath.
Method of working when dyeing with substantive dyes in the jigger.

The substantive dyes are now very extensively used for cotton piece dyeing as one can work very quickly with them. They also penetrate very well and the dyeings obtained with them are sufficiently fast to rubbing.

Topping with basic dyes, after-treatment with copper salts, or diazotising and developing are carried out according to the same principles as when working with cotton yarn.

The following method of working is generally suitable when dyeing piece-goods with substantive dyes:

In cases where soda is required it is added to the lukewarm dye-bath first and the colour solution is then added in several portions. The colour solution is added each time the direction in which the pieces are running is changed. The bath is now raised slowly to the boil and the pieces are passed several times through the boiling liquors. The Glauber’s salt, common salt, &c., which are necessary when working with certain colours, are only now added. (See page 143 and following pages.)

Finally boil until the dyeing is complete and then rinse with a little water.

In another frequently used method, the warm dyeing bath has the fixing agent (Glauber’s salt, common salt, &c.) added to it and before the dye is added the goods are passed through the liquor a few times, then a beginning is made with the gradual addition of the dye-solution.

About 1½ hours are required for dyeing with substantive dyes which do not require an after-treatment.

Example.

Medium Blue with Oxamine Blue RX.

3 pieces of twills weighing 110 lbs.; length 295 yards.

Boiling-out.—Pass the goods 4—6 times through a boiling solution of 2½ lbs. of soda in 44 gallons of water.

Rinsing.—Pass twice through cold water.

Dyeing.—Dye in a fresh lukewarm bath which contains 22 gallons of water, 5½ lbs. of Glauber’s salt (crystals) and the half of a solution obtained by dissolving 2 lbs. Oxamine Blue RX in 11 gallons of water.

Pass the goods once through the bath which has been prepared in this manner, add the other half of the colour solution and pass once again. Raise to the boil whilst the pieces are passing through and pass 4 times through the boiling liquors. Turn off the steam and run through another 4 times.

If the bath has not exhausted sufficiently or if the shade is not dark enough, add 3½—5½ lbs. of Glauber’s salt and pass through again several times.

Rinsing.—Pass twice through a fresh bath of cold water.
Example.

To produce a brown shade with Kryogene Brown (sulphur colour) and a topping of basic colours.

3 pieces of cords weighing about 110 lbs.

Grounding.—To 33—44 gallons of water add the half of a solution of 10 lbs. Kryogene Brown and 33 lbs. of common salt.

Enter the cords immediately after boiling out and hydro-extracting into the bath which should have a temperature of about 120° F. and pass the pieces once through. Now add the other half of the colour and run the pieces 7—8 times through (3/4 hour) at 120—140° F.

The goods are now immediately and thoroughly rinsed in continuously running water, being passed through this 6 times (1/2 hour). A perforated pipe from which jets of water are projected against the goods are specially adapted for this rinsing.

Topping.—Top with basic colours in a fresh cold bath which contains 44 gallons of water and 3/4 gills acetic acid 9° Tw.

For this purpose dissolve

\[ 4\frac{1}{2} \text{ oz. Vesuvine B.L} \]
\[ 3/4 - 1 \text{ oz. Auramine II} \]

in hot water and add this solution in 4 portions to the vat. These additions are made each time the direction in which the pieces are running is reversed.

Finally complete the dyeing by passing through 3—4 times (about 20 minutes). Rinse in two lots of water running the goods 2—3 times through each lot.

Example.

To produce a black shade with Kryogene Black B, BG, or G.

2 pieces of cotton cloth weighing about 50 lbs.

Prepare the first bath for example with

10 lbs. Kryogene Black B, BG, or G
5 » sodium sulphide
10 » calcined soda
15 » common salt (or, if necessary, calcined Glauber's salt)
and about 35 gallons of water.

Enter the boiled-out yarn into the boiling hot dye-bath, dye for about 3/4 hour and then rinse thoroughly.

After-treatment.—In order to increase the degree of fastness (also as far as possible to prevent the yarn becoming bluer on storing) work the goods for \( \frac{1}{2} \) hour at 160—175° F. in a bath which contains

1 lb. copper sulphate
1 » potassium bichromate
1\( \frac{1}{2} \) lbs. acetic acid 9° Tw.

Subsequently rinse thoroughly.

The above treatment also brings about an improvement in the shade, causing it to lose the brownish tint which it sometimes possesses.

Brightening.—A further considerable improvement in shade is brought about by a subsequent brightening.

7 oz. potato-flour or starch
7 » lard, cocoa-nut oil, &c.

are boiled up well together, and then added to the brightening bath which should have a temperature of 140—160° F., and the goods are worked in this for \( \frac{1}{4} \)—\( \frac{1}{2} \) hour. An addition of 1 lb. 2 oz. Turkey-red oil also considerably enhances the beauty of the shade.

Another method of brightening which likewise produces a substantial improvement of the shade is as follows:—

3\( \frac{1}{2} \) oz. soap
3\( \frac{1}{2} \) » olein
3\( \frac{1}{2} \) » cotton oil (olive oil, rape oil, &c.)
3\( \frac{1}{2} \) » ammonia

are boiled up well together, and then added to the brightening bath which should have a temperature of 140—160° F., and the goods are worked in this as described above. An addition of 1 lb. 2 oz. Turkey-red oil has also a beneficial effect.

In most cases, the above-described brightening processes can be omitted, as the goods are almost always subjected to some finishing process, which has the same effect as the treatment described above.

Remarks.

The colour is dissolved by mixing it with the sodium sulphide, and then pouring boiling water over it and stirring it until solution is complete.

When dyeing two pieces of cotton cloth, weighing about 50 lbs., in an old bath, one would require to replenish it with about

6 lbs. Kryogene Black B, BG, or G
4 » sodium sulphide.

In many cases, the above-described treatment of the black with bichromate of potash, copper sulphate, &c., or copper sulphate, &c. can be omitted. It should be noticed, however, that this treatment prevents the pieces from becoming too blue on storing and therefore from appearing to have become weaker.

Kryogene Black liquors, when not in use, should always be kept covered up.

The arrangement of the Foulard Machine is similar in many respects to that of the jigger.

The material to be dyed is rolled evenly on to a roller and then passed through the dye-liquor which is contained in a small trough. It is then run through a squeezing arrangement which generally consists of three, seldom of two rollers, and from there it is wound on to a second roller.

In all cases the quantity of water in the dye-trough is considerably smaller than the amount which is used in the jigger and is generally about 7—16 gallons. As the liquor is used up it is replaced by fresh solution which flows in or is ladled in from a tank at the side.

The Foulard Machine is very often used for padding, and in such cases some thickening agent, e. g., dextrine, starch, &c., is added to the dye-liquor and the goods are run through it.

If the desired shade is not obtained by one passage the goods are run through again, as often as may be necessary. For this purpose the roller on to which the cloth is wound is taken out and put in the place of the empty roller.

If substantive dyes are used it is often advisable to add a little soap, and for delicate shades a little sodium phosphate. Glauber's salt and common salt are generally omitted when padding.

For medium and light shades a temperature of 120° F. is generally sufficient, and for dark shades it is increased to about 170° F.

In most cases the goods are dried and finished without rinsing. If they afterwards require to be subjected to some finishing process slight divergences in shade can be corrected by adding a little colour to the finish.

The above-described method is extensively used for those materials with which quick working is of more importance than proper fixation of the colour. It is quite plain that when working according to this method the colour, as a rule, cannot be properly fixed, for in most cases the dyestuff is not properly absorbed by the fibre but the goods are simply impregnated with the thickened colour solution.

If, however, instead of being padded, the goods require to be dyed in the Foulard Machine by a method similar to that used for dyeing in the jigger, the rules of working which were given when describing the jigger, also hold good in this case.

In this case the addition of thickening agents (dextrine, &c.) is omitted and the usual fixing agents are added in their place.

For example, when working with substantive dyes Glauber's salt, common salt, soda, Turkey-red oil, &c. are added.

The chief difference between the jigger and the Foulard Machine is that the squeezing rollers of the latter produce quicker penetration and the goods do not require to be passed through the liquid so often.
Example.

1. Fashionable Brown with Substantive Dyes.

3 pieces of raw twills, weight 73 lbs., length 160 yards.

Boiling-out.—Pass 3—4 times through about 4 1/2 gallons of boiling water containing 2 1/4 lbs. of calcined soda.

Rinsing.—Pass once through fresh cold water.

Dyeing.—Prepare the dye-bath with about 4 1/2 gallons of water, 1 1/4 oz. calcined soda, 17 3/4 oz. Glauber's salt and the half of a solution obtained by dissolving

- 2 1/4 oz. Cotton Orange R
- 1 1/8 » Phenamine Blue R
- 1/4 » Thiazine Red R

in boiling water. Enter the goods into this bath which should have a temperature of 105° F. and run through once. Now add the other half of the colour solution and pass through again at 122° F., raise to the boil and pass through 2—3 times more.

Rinsing.—Rinse by passing once through fresh cold water.

2. Grey with Substantive Dyes.

3 pieces of bleached twills, weight 68 1/4 lbs., length 158 yards.

Wetting-out.—Wet by passing once through boiling water.

Dyeing.—Prepare the dye-bath with 4 1/2 gallons of water, 2 1/4 oz. calcined soda, 9 oz. Glauber's salt and the half of a solution obtained by dissolving in boiling water

- 3/4 oz. Cotton Orange G
- 3/4 » Cotton Orange R
- 1 1/4 » Phenamine Blue R.

Pass the goods once through this bath at a temperature of 105° F., add the other half of the colour solution, pass through once at 120° F., raise the temperature to 140—160° F. and pass through twice.

Rinsing.—Rinse by passing once through fresh cold water.


(See page 494 and following pages.)
Loose Cotton.

Apparatus used for dyeing.

Loose cotton is still dyed to a great extent in the same manner as loose wool, in large bulging copper boilers with broad rims which slope inwards. At the present time they are almost exclusively heated with an open or closed steam pipe placed under a perforated false bottom.

Another method is to work with a boiler which has a flat bottom on which lies an uncovered closed steam pipe. In this case the cotton is placed in a large and strong wire basket which is lowered into the dye-vat by means of pulleys.

In most cases the first kind of vat will hold 450 lbs. and the latter only 220 lbs.

In several instances mechanical dyeing apparatus are used, and these are arranged so that the cases into which the cotton is packed can be taken out. This method is, however, only used to a limited extent for loose cotton, but on the other hand it is extensively used for cotton sliver, cheeses, cops, &c. (see page 221).

As a rule wooden vats are only used for loose cotton in those cases where the use of metal vessels is not permissible on account of their detrimental action on the shade in question. On the other hand, they have recently been extensively introduced for diazotising and developing substantive dyes. For this purpose a system of 3 vats is used, the first of which serves for diazotising, the second for acid rinsing, and the third for developing (see page 190).

To carry out these operations the dyed and hydro-extracted cotton is contained in a net which can be raised by means of pulleys and let down into the vat. After being taken out again and let drain the pulley is pushed along a shaft and the net lowered into the following bath.
In many cases the diazotising and developing process is effected in the rinsing machine.

Another system which has recently been introduced for dyeing loose cotton depends upon the use of an octagonal drum. This consists of a wooden frame covered over with a coarse wire sieve. It holds about 1100 lbs. of loose cotton and rotates slowly in a wooden vat which is only a little larger than the drum. The vat contains the liquor and the heating arrangement.

The method of working just described permits of large quantities of cotton being dyed (3 lots of 1100 lbs. each per day in each machine).

Good results are obtained as the cotton, which is raised by the drum, at each revolution falls back again and by its own weight produces good penetration.

Dyeing of loose cotton.

The principles of the methods already described for dyeing cotton yarn also hold good for the dyeing of loose cotton. In the latter case, however, as it has generally to be spun afterwards, care must be taken not to damage its spinning properties.

The dyer should therefore try to avoid as far as is possible the use of any assistants which would make the cotton hard or sticky, e.g., alumina mordants, tin compounds, alum, soap, &c.

As the demands with regard to evenness of the shade are very much less in the case of loose cotton than with yarn or piece-goods, a satisfactory substitute can be found in most cases for the above substances.

For example, acetic acid can be used in many cases in place of alum or sulphate of alumina. Soap itself is not injurious, but in the form of lime soaps formed by the action of hard water it becomes so. It is therefore generally replaced by a small quantity of soda.

If, however, the use of soap cannot be avoided, distilled water must be used, or, as this cannot as a rule be obtained in sufficient quantity, ordinary water must first be corrected before adding soap by being warmed up with a sufficient quantity of soda.
Loose Cotton. Dyeing.

From what has already been said it will be quite clear that the substantive dyes are of the most interest for loose cotton as they do not require any previous mordanting or the addition of any detrimental assistant to the dye-liquors.

They are therefore always used for this purpose when their properties (e.g., bleeding into the white) allow it and when the shade required can be produced with them. In several cases the fastness against bleeding into white can be so improved by an after-treatment with metal salts or by diazotising and developing that there can be no ground for complaint in this respect. (See pages 148 and 190.)

Management of the dyeing process.

If possible one avoids boiling out the loose cotton. It is therefore taken direct from the bales and placed in the boiler, especially when working with substantive or wood colours.

As the cotton is difficult to wet out on account of being pressed so tightly, only a part of the cotton is thrown into the boiling liquid and the remainder is piled up on the broad rim of the boiler.

The liquid as it boils up then gradually wets this cotton so that it separates out easily when pushed down into the boiler.

The cotton must be well raked about by several workmen, especially at the beginning, or else it will be impossible to avoid the tight knots remaining white.

As a rule the dyeing is completed in one hour's time, after which it is thrown out and, if necessary, rinsed and hydro-extracted.
Loose Cotton. Special dyeing process for Kryogene Black.

Special dyeing process for Kryogene Black BA, B, BG, and G.

For 100 lbs. loose cotton.

Prepare the first bath with:

- 20 lbs. of Kryogene Black BA, B, BG, or G
- 10 » » sodium sulphide
- 10 » » calcined soda
- 40 » » common salt
- 3/4—1 1/2 pints of Turkey-red oil F
- 120—150 gallons of water.

Enter the loose cotton into the boiling bath and work for 1—1 1/2 hours at this temperature. Take out, let drain (or better still squeeze out) and rinse well.

Remarks.

Either wooden or iron vessels should be used for dyeing. Copper vessels and heating pipes cannot be used.

It is advisable to work with indirect steam (closed steam pipes), as if direct steam is used the liquors must become very dilute.

The dyestuff is dissolved by mixing with sodium sulphide, pouring boiling water over it, and stirring until solution is complete. This solution is then poured into the dye-bath, to which the common salt has already been added.

The amount of colour, &c., required for replenishing an old vat depends upon the quantity of the liquor that has been lost. As a rule, it is only necessary to add about

- 12 lbs. of dyestuff
- 6 » » sodium sulphide
- 1 1/2 gills of Turkey-red oil F.

If it is desired to increase the fastness, especially to storing, (to prevent as far as possible the shade becoming bluer) the loose cotton is treated for 1/2 hour at 160—175° F. with a solution of

- 2 lbs. of copper sulphate
- 2 » » potassium—or sodium—bichromate
- 3 » » acetic acid 9° Tw.

This treatment also renders the shade somewhat bluer. In many cases it can be omitted.
Brightening.

A further considerable improvement in the shade can be produced by brightening.

\[
\begin{align*}
9^{1/2} \text{ oz. of soap} \\
9^{1/2} \quad \rightarrow \quad \text{cotton oil (olive oil, rape oil)} \\
9^{1/2} \quad \rightarrow \quad \text{olein} \\
9^{1/2} \quad \rightarrow \quad \text{ammonia}
\end{align*}
\]

are boiled up well together in about 10 gallons of water, and added to the brightening bath which should have a temperature of about $140 - 160^\circ F.$, and the loose cotton is worked in this for about $1/2$ hour. An addition of $2 - 3$ lbs. of Turkey-red oil F has also a beneficial effect.

The latter method of working imparts to the cotton a softer feel.

Kryogene Black liquors, when not in use, should be kept well covered up.
The dyeing of Unspun Cotton.

The methods and general rules of working are the same as those for cop-dyeing, cheese-dyeing, &c.

As these are discussed on page 221 they do not require to be described here.
Dyeing of Cotton Warps.

In this case the yarn is not dyed in the reeled or hank form but as a long chain consisting of a very large number of threads.

Various apparatus are used for this purpose. The one which is most frequently used at the present time is the so-called warp dyeing machine. The warp runs over rollers in a dye-vat which may contain one or several partitions.

In the former case the system of rollers is generally so arranged that the warps run parallel to each other and pass horizontally through the liquid, whereas if the vat contains several compartments the warps pass up and drawn vertically.

In each case the warps pass through squeezing rollers on leaving each box and there is an arrangement for running back the liquor into the compartment it has just left.

If the warps require to pass through the liquor several times they pass through the squeezing rollers of the first compartment into the second, third, and so on. They are finally dried on hot cylinders.

Working with the above-described machine requires great care, and in fact it is only suitable for dyeing large quantities, whereas dyeing in a vat is considerably simpler and easier.

The vats used for this purpose are similar to those used for woollen yarn but they are considerably deeper and broader.

In the middle is a perforated partition which runs from end to end and divides the vats into two halves. Above this partition is a winch which runs parallel to it. In some cases the winch is replaced by a squeezing roller.
When dyeing, the warp is run over the reel or through the squeezing rollers from one division to the other and when all has passed over it is run back again into the former division in exactly the same manner.

A number of warps are always dyed alongside each other at a sufficient distance apart. They are kept from running foul of each other by some suitable arrangement (wooden laths).

---

Method of dyeing.

In principle the method of dyeing is exactly the same as the dyeing of cotton yarn in the hank which has already been described (see page 143 and following pages). The only differences to be made are those arising from the machines used.

Substantive dyes have recently been extensively used for this purpose, either as such or diazotised and developed on the fibre.

The following is the method used for dyeing with substantive dyes in the warp dyeing machine:

The warps are first passed through boiling hot water to which a little soda has been added. They are then run into the dye-vat which (as is the case when working with the jigger) only contains enough diluted colour solution to almost cover the lower roller. During the dyeing process concentrated colour solution and Glauber's salt solution are continually run in from a tub which is fixed at the side.

The rate of flow should be so arranged that the quantity which is necessary for the whole lot, is added by the time the warps have passed once through the liquid, if that is sufficient, or whilst passing several times.

Whilst dyeing the temperature should be kept as near to the boiling point as possible without allowing the liquors to froth up.

Of course, the details of the process depend upon local conditions, on the nature of the dyestuff, and upon the depth of the shade required.

For example light shades frequently require only one passage whereas for dark shades the warp may have to pass through as many as six times. Of course, upon this again depends the rate of flow of the solutions of colour and fixing agent that have to be added, &c.
If only hard water can be obtained it must first be corrected with a little soda.

If dyeings produced with substantive colours require to be developed, the warps are passed from the dye-vat through a small cold rinsing vat and then through a system of rollers similar to those described for developing colours on piece-goods (see page 203).

The dyeing of warps in the vat scarcely requires to be further discussed. The warps naturally remain the whole time in the vat and after mordanting, rinsing, treating with copper salts, diazotising, developing, &c., the old liquor is generally run off and the solution for the following operation introduced.

When producing dark shades with substantive or developed colours the most rational method of working is to use a system of several vats, so that, after the warps have completely passed through one process, they can be passed over to the next vat.

As already mentioned, working in the vat is altogether easier than working in a warp dyeing machine. This is especially the case when working with mordant or developed colours, as the squeezing out which is required between the various operations can be carried out to any desired extent, as there is no fear of the warp being broken.

In addition to this since the whole length of the warp is simultaneously in the liquid, there is no danger of the shade becoming lighter at the ends as is the case when using colours which exhaust rapidly, in the warp dyeing machine, if the addition of the solutions is not carefully regulated.
Dyeing of Cops, Cheeses, &c.

These are dyed in mechanical dyeing apparatus in the same way as unspun cotton (slubbing, &c.). (For the dyeing of cheeses in the froth of the dye-liquors without any special apparatus, see page 226.)

Where possible substantive dyes are used, either as such or developed on the fibre as they are altogether better adapted for this purpose than those products which require to be fixed on a mordant.

The general rules when dyeing are practically the same as those for yarn, but it must be remembered that not only is the proportion of liquor to cotton different, but also that these goods are more difficult to penetrate as they are reeled more tightly, and in several instances they are packed more tightly into the apparatus.

Working with Substantive Dyes.

From what has just been stated it is easy to see that only products should be chosen which are easily and completely soluble and which penetrate well. In most cases the latter property can be improved by adding a little soda to the liquor or to the colour solution.

If the water is hard this soda softens it, and also prevents the formation of difficultly soluble lime lakes which are liable to form with several colours. It also tends to prevent the formation of bronzy dyeings.
1. The following substantive dyes are specially suitable for dyeing cops and cheeses both light and dark shades:—

- Sulphine A⁽¹⁾, N⁽¹⁾. Pyramine Yellow G⁽¹⁾ or 2. Cotton Orange G⁽³⁾, R⁽¹⁾. Thiazine Brown G⁽¹⁾, R⁽¹⁾. Oxamine Brown M⁽¹⁾. Cotton Brown RN⁽¹⁾, RY⁽¹⁾. Pyramine Orange RR⁽¹⁾. Thiazine Red G⁽¹⁾, R⁽¹⁾. Phenamine Blue G⁽³⁾, R⁽³⁾, B⁽³⁾. Violet Black⁽⁵⁾. Oxamine Black N⁽¹⁾ or 2, A⁽¹⁾ or 2.

These products can be dyed at the boil with an addition of common salt or Glauber’s salt, but still those marked⁽¹⁾ give clearer and fuller shades if common salt is used; whilst Pyramine Orange RR, marked⁽²⁾, gives somewhat brighter shades with Glauber’s salt.

When working with those marked⁽³⁾ it is advisable to add a little soda in addition to Glauber’s salt, so as to obtain fuller shades.

Kryogene Brown G, Kryogene Olive, Kryogene Black B, BG, G are also suitable for producing light and dark shades.

They are dyed at the boil with an addition of a little Turkey-red oil and a suitable quantity of sulphide of sodium to the liquors. For dark shades a little common salt or Glauber’s salt is added.

(Details for working with Kryogene Black, &c., are to be found on page 224.)

2. The following are suitable for producing medium and dark shades:—

The above-mentioned products, also Cotton Yellow GIT⁽¹⁾, GR⁽¹⁾, GRR⁽¹⁾, R⁽¹⁾. Pyramine Orange 3G⁽³⁾. Oxamine Brown MN⁽³⁾. Cotton Brown G⁽³⁾. Copper Brown⁽²⁾. Cotton Red 4B⁽²⁾. Oxamine Red⁽³⁾. Oxamine Claret M⁽³⁾. Oxamine Garnet M⁽³⁾. Oxamine Violet⁽³⁾. Oxamine Blue B⁽³⁾, RX⁽³⁾, RRR⁽³⁾. Oxamine Dark Blue M⁽³⁾. Oxamine Green M⁽³⁾. Oxamine Dark Green M⁽¹⁾. Also Sulphine A⁽¹⁾, N⁽¹⁾ diazotised and developed on the fibre. Oxamine Blue RRR⁽³⁾ diazotised and developed on the fibre. Oxamine Violet⁽³⁾ diazotised and developed on the fibre.

When dyeing with colours marked⁽¹⁾⁽²⁾⁽³⁾ the additions are as mentioned above.

With those marked⁽¹⁾ purer, fuller, and more even dyeings are obtained by adding Glauber’s salt, sodium phosphate (½ oz. per gallon), and some Turkey-red oil.
In most cases when producing light shades it is advisable to commence lukewarm if colours of group 2 are used. If one wishes to begin at the boil, Turkey-red oil or some similar assistant must be used.

For diazotising and developing on the fibre the fundamental rules mentioned on page 191 and following pages for cotton yarn also hold good here. The dyed cops are allowed to cool completely, rinsed slightly, diazotised for 20 minutes cold, rinsed in water to which a little acid has been added, developed for about 25 minutes cold and then rinsed again.

If the whole process is to be carried out in the same apparatus, several wooden tubs should be placed near it for receiving the dye-liquors, diazotising liquors, and developing liquors as they are run off. These can be used again if the usual precautions are observed.

When working with developed colours care must always be taken that the apparatus itself has completely cooled down before using it for diazotising and developing.

**General Notes.**

a) In all cases where soda is used it is advisable, to first add it to the water and boil up and then to add the colour solution and any other additions.

b) If the cops appear bronzey on the surface, probably too little soda has been added. In such cases it is not advisable to add more than $2^{1/2}$ oz. of salt or Glauber's salt per gallon of water. The main point to observe if it is found difficult to obtain level dyeings is not to use too much fixing agent, and when working with old liquors especially the amount added must be greatly reduced.

The chief difficulty will be overcome if matters are so arranged that a considerable amount of colour remains in the liquors after the desired shade has been obtained, i.e., the colour should not be forced on to the fibre.

An addition of $1/3$ oz. of Turkey-red oil per gallon also helps to produce level dyeings.

c) If products are used which are very easily soluble and which therefore do not bronze, e.g., Thiazine Red, Thiazine Brown, &c., the rule given in note b with reference to the amount of Glauber's salt or common salt does not hold good. If, therefore, these colours do not exhaust sufficiently the amount of common salt is increased as required.
d) The cops can be dyed without having been boiled out when working with the colours mentioned under group 1, or with other shades that are not too sensitive, if the other conditions of working are suitable.

When working with cops which are difficult to dye or if difficulty is found in producing certain light shades with colours marked (o), it is advisable to previously boil out the cops with a little soda. When dyeing add a little Turkey-red oil and enter at 120° F.

Special process for dyeing with Kryogene Black.

For 33 lbs. cops.

Boil out for 1/4—1/2 hour. An addition of 5 1/3 oz. Turkey-red oil is of advantage. Run off the water and dye without rinsing with

- 8 1/4 lbs. of Patent Kryogene Black BG
- 5 lbs. of sodium sulphide
- 1 lb. 5 oz. of calcined soda.

Dye at the boil for 1/4 hour, then add 8 1/2 lbs. common salt and boil for 1/2 hour longer. Rinse twice with hot water and then with cold water until the water comes away clear.

Remark.

The dyestuff is dissolved by boiling together with the sodium sulphide and soda, and is then added to the dye-bath. For replenishing an old bath add about 1/2 of the original quantities of dyestuff, sodium sulphide, and soda, and about 1/3 of the original amount of common salt.

N.B.—With regard to the prevention of the shade becoming bluer on storing, see page 209.
Working with basic colours in the dyeing apparatus.

This is in one respect a difficult process, as the loose tannin-antimony lake which is always formed between the fibres is carried on by the liquid and deposited on the outward parts of the cotton. This not only renders it more difficult for the liquid to penetrate to the interior, but later on causes the colour to rub off more or less badly in those places.

This inconvenience becomes still greater the thicker and more closely packed the material is.

It can be avoided by inserting an arrangement in the apparatus for filtering the antimony liquors after they have passed for the first time through the tannin-mordanted cotton. In this manner the precipitate is removed before it can be deposited in the material.

The best results are obtained with an apparatus which is fitted with a strong suction pump which draws the liquid in one direction through the material.

When dyeing cops with basic colours they should not be too strongly mordanted. For a full shade, therefore, 1—2 lbs. of tannic acid are used for 100 lbs. of cops, and when possible they are treated with this for several hours and then mordanted with antimony salt.

After thoroughly rinsing they are dyed, a little acetic acid being added to the dye-liquors.

Several basic colours, e.g., *Rhodamine S, 6G*, (in light shades), *Victoria Blue B*, *Indoine Blue BB* can be dyed on unmordanted cotton with the sole addition of a little acetic acid or sulphate of alumina to the liquors. (See pages 158 and 164.)
Dyeing of cheeses in the froth of the dye-liquors.

This method which does not require the use of a complicated apparatus has been extensively introduced for dyeing certain shades on cheeses.

An ordinary high wooden vat is used, at the bottom of which are many coils of a closed steam pipe. The dye-liquors only fill \( \frac{1}{3} \) of the vat and can thus be caused to froth up to the top. The cheeses are dyed in this froth with substantive dyes. They are placed in a box made from wooden laths which can be let down into the vat by means of pulleys and taken out in the same manner. A small quantity of Glauber's salt is usually added to the liquors.

On an average the time required for dyeing is \( 1\frac{1}{2} \) hours.

Notes.

a) With regard to the choice of colours, see page 222. Those in group 1 are specially suitable.

b) In order to produce good results the cheeses must always be completely covered with foam, the quantity of liquid present must not be too great or too small, and the right quantity of Glauber's salt must be added. If too much Glauber's salt is used the colour is absorbed too rapidly, and if too little, the liquors will not foam sufficiently.

c) A considerable saving is effected by fitting the steam-coil with an arrangement for running the condensed water back into the vat.

d) Satisfactory results cannot be obtained with cops by the above method, but cotton yarn can be dyed in the rope form, in warps, &c.
Dyeing of Mercerised Yarn.

The action of caustic soda on cotton is to change its structure and chemical character which increases the affinity of the cotton for dyestuffs.

For this reason the substantive dyes are exhausted much more rapidly than is the case when working with ordinary cotton, but the amount of colour which is fixed on the fibre is no greater.

Mercerised cotton absorbs the basic colours to a certain extent without having been previously mordanted. Only light shades, however, can be produced in this manner, and, therefore, in most cases a previous mordanting is required.

It is only in a few cases that the dyer can save mordant or colour when working with mercerised cotton, and even when this is the case the saving is counterbalanced by the extra care which the yarn or pieces require on account of the tendency to dye uneven, due to the colour being absorbed so rapidly and also because an after-treatment is necessary.

However, since large quantities of cotton which has been mercerised under tension to give it a lustre similar to that of silk are now dyed, we will give a short description of the methods which are used for this purpose.

In principle they are exactly the same as those which are used for dyeing ordinary cotton, but one must always work more slowly or add substances which retard the dyeing.

For example, when dyeing 10 lbs. of yarn with substantive dyes the vat is prepared with

- $8\frac{3}{4}$ oz. of soap
- $1\frac{3}{4}-5\frac{1}{4}$ » » crystal soda (or half this quantity of calcined soda)
- $8\frac{3}{4}$ oz. $- 2\frac{1}{4}$ lbs. » Glauber's salt or common salt,

and the yarn is dyed for $\frac{3}{4}-1$ hour at the boil.
When dyeing with *Sulphine*, *Cotton Yellow GI, GR, GRR*, *Oxamine Blue B, Oxamine Green MN* the soda is omitted.

When dyeing light shades or any others which are difficult to dye even, enter the yarn cold and raise slowly to the boil. The colour solution and any Glauber's salt or common salt that may be necessary should be added in several portions.

After dyeing rinse. Those shades which have been produced with colours which are fast to acids should be brightened with a little acetic acid or with a trace of sulphuric acid.

If the yarn has to be dyed with *basic* colours it should be boiled for 1/2 hour before mordanting, in water which contains 3/4 oz. of soap per gallon, after which it is rinsed. Now mordant in the usual manner with tannic acid, fix with tartar emetic, rinse again, and dye. Enter into the cold dye-bath, raise to 120° F. and add a little acetic acid to the dye-bath.

**Note.**

The soaping before mordanting and dyeing with an addition of acetic acid gives the yarn a silky handle. A still better handle is obtained if the dyed cotton is impregnated with a 1/2 percent solution of salicylic acid or benzoic acid and then dried without rinsing.
Dyeing in the Size.

Cotton is sized both in the warp and in the hank, and the method used depends upon the purpose for which it is intended.

In the first case special apparatus are used, viz:—

1. such as are used for sizing the warp in the rope form,

2. such as are used for sizing the warp which has already been beamed (sizing machines).

The first mentioned machine consists chiefly of a wooden vat which contains the ordinary size or coloured size. It is best to warm the latter with indirect steam.

At the bottom of the vat is a series of rollers which are placed so close together that the warps — several of which are sized together — are slightly squeezed as they pass through. In addition to these guiding rollers, several pairs of squeezing rollers which are considerably thicker than the former are placed both inside and above the vat.

The warps pass through at such a speed that each part remains $\frac{1}{2}$—1 minute in the size. A warp which is 400—500 yards long requires about 10 minutes to pass through.

Whenever possible, one passage is made to suffice, but in many cases it is necessary to pass the warps through twice.

After sizing, dry, brush on the beaming machine, and beam.

The above apparatus is used both for dyeing in the size and for sizing previously dyed warps.

In this place we only treat of the dyeing of warps in the rope form. The second kind of machine sizing, viz., working on the sizing machine is not described, as in this case the warp is always dyed and beamed before being sized.
Example of how to produce a size which is suitable for dyeing.

100 lbs. of wheat flour is stirred with water to a thin paste in a wooden vessel fitted with a stirrer. This is then stirred 2—3 days until perfectly uniform so that no more lumps are present.

At the same time 100 lbs. of potato flour is treated in the same manner, the only difference being that it becomes uniform much quicker.

These two pastes are then run together into another vessel which is also provided with a stirrer and which is generally placed above the sizing trough. To this mixture are now added

- 1 lb. Japanese wax
- 12 lbs. cocoa-nut oil
- 50 » magnesium sulphate
- 100 » China clay.

This is now diluted down to 150 gallons and thoroughly stirred for 2—3 hours. It is then boiled for 1 hour or until the mixture is thick enough.

The dyestuff which has first been completely dissolved is then added and the boiling is continued until the size has the correct feel. The whole or part of it is now run into the sizing trough and the dyeing is commenced.

Notes.

In addition to the substances mentioned above magnesium chloride is frequently added as a weighting agent, also substances which help to promote penetration are added in small quantities, e.g., Turkey-red oil.

The consistency of the size differs in various cases; for fine yarns it is required thinner than for coarser yarns.

Of the Aniline Colours the substantive dyes are the most extensively used for dyeing in the size. The acid dyes are also employed for several shades (grey, blue, cream, white).

We have found by experience that when working with substantive dyes the 50 lbs. of magnesium sulphate can be suitably replaced by 20—30 lbs. of potash or an equal quantity of calcined soda. For weighting 50—100 lbs. of barium sulphate can then be added.

When working with acid dyes one can add 20 lbs. of magnesium sulphate in place of 50 lbs. and also 30 lbs. of barium sulphate.
Sizing in the hank

(for coloured cotton goods).

According to this method the yarn is sized or dyed in the size in 1-lb. lots.

This is done in a small trough above which are two wooden rollers. The hanks run between these and remain for about \(\frac{1}{2}\) minute in the size. They are then squeezed out in the machine or wrung out, shaken out, brushed, and dried.

The following colours are specially adapted for dyeing in the size according to either method:

Substantive dyes:


- Our other brands which are not mentioned here also give good results.

Acid dyes:

- Azoflavine RS. Metanil Yellow (dyed without alum). Orange X. Cotton Scarlet. Erythrine RR, X, P. The various Nigrosine and Soluble Blue brands. (For white especially the reddish Soluble Blue 4 R, TR, IV red shade.)
Pattern-Sheets.

Cotton.
Cotton.

Dyed directly with **substantive** dyes without previously mordanting.

| Cotton Yellow G1 | Cotton Orange G | Cotton Claret M |
| Cotton Yellow GR | Cotton Orange R | Oxamine Garnet M |
| Cotton Yellow GRR | Pyramine Orange 1G | Oxamine Maroon |
| Cotton Yellow R | Pyramine Orange R | Oxamine Violet |
| Carbazol Yellow | Pyramine Orange RR | Oxamine Blue RRR |
| Thiazine Brown G | Salmon Red | Oxamine Blue RX |
| Thiazine Brown R | Cosmos Red | Phenamine Blue R |
| Cotton Brown RN | Cotton Red 4B | Phenamine Blue B |
| Copper Brown | Thiazine Red G | Oxamine Dark Blue M |
| Cotton Brown RV | Thiazine Red R | Oxamine Blue B |
| Cotton Brown G | Oxamine Red | Oxamine Blue BG |

Sheet 5.
Cotton.

Dyed directly with dyestuffs of various kinds without previously mordanting.

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 Antarquione Black not chromed.
 Antarquione Black chromed.
 Kryogene Brown.
 Kryogene Blue R.
 Kryogene Black B.
 Kryogene Black G.
 Pure Blue I.
 Soluble Blue I.N.
 Fast Blue 5 B.
 Fast Blue R.
 Nigrosine W.
 Nigrosine WH.
Cotton.

Dyed with **basic** dyes on a tannin-antimony mordant.

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<td>Methyl Violet RRRR.</td>
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</table>
Cotton.

Dyed with basic or certain acid dyes on a tannin-antimony mordant.

<table>
<thead>
<tr>
<th>Dyed Material</th>
<th>Methyl Soluble Blue</th>
<th>Diamond Green B</th>
<th>Diamond Green G</th>
<th>Dark Green paste (Process 1, Note 6, page 173)</th>
<th>Dark Blue R.</th>
<th>Dark Blue B.</th>
<th>Dark Blue R.</th>
<th>Cotton Blue B.B.</th>
<th>Cotton Blue R.</th>
<th>Indigo Blue BB paste (Light shade) (Special process, page 482)</th>
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<tbody>
<tr>
<td>Methyl Violet B.B.</td>
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<td>Crystal Violet</td>
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<td>Ethyl Purple 6 B.</td>
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<td>Marine Blue R R N.</td>
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<td>Victoria Blue 4 R.</td>
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<td>Victoria Blue B.</td>
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<td>Soluble Blue IV red shade.</td>
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<td>Pure Blue I.</td>
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<td>Soluble Blue I N.</td>
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Nile Blue R
Nile Blue A.
Nile Blue BB.
Jet Black.
## Cotton
Dyed with colours which are developed, or produced on the fibre.

| Cotton Yellow G I developed with Nitroamine solution treated with a copper salt and coagulated. | Cotton Yellow G I + Pyramine Orange 3G + Cotton Black BN developed with Nitroamine solution and treated with a copper salt. | Oxamine Violet 
developed and developed with Oxamine Developer B. (Dark shade.) |
|---|---|---|
| Sulphine A diazotised and developed with sodium. | Cotton Yellow G I + Cotton Black BN developed with Nitroamine solution and treated with a copper salt. | Oxamine Violet 
developed and developed with Oxamine Developer B. (Light shade.) |
| Sulphine A diazotised and developed with sodium. | Oxamine Red developed with Nitroamine solution and treated with a copper salt. | Oxamine Violet 
developed and developed with Oxamine Developer B. (Light shade.) |
| Sulphine A diazotised and developed with sodium. | Oxamine Maroon developed with Nitroamine solution and treated with a copper salt. | Oxamine Violet 
developed and developed with Beta-Naphthol. (Light shade.) |
| Nitrosamine Red in paste. | Oxamine Blue RRR diazotised and developed with Oxamine Developer B. (Light shade.) | Oxamine Blue BG 
developed and developed with Oxamine Developer B. (Dark shade.) |
| Sulphine A diazotised and developed with Beta-Naphthol. | Oxamine Blue RRR diazotised and developed with Oxamine Developer B. (Dark shade.) | Oxamine Blue BG 
developed and developed with Oxamine Developer B. (Dark shade.) |
| Sulphine A diazotised and developed with Alpha-Naphthol. | Oxamine Blue RRR diazotised and developed with Oxamine Developer B. (Dark shade.) | Oxamine Blue RRR 
developed and developed with Alpha-Naphthol. |
| Sulphine A diazotised and developed with Oxamine Developer B. | Oxamine Blue RRR diazotised and developed with Oxamine Developer B. (Light shade.) | Oxamine Blue RRR 
developed and developed with Oxamine Developer B. (Light shade.) |
| Sulphine A diazotised and developed with Oxamine Developer M. | Oxamine Blue RRR diazotised and developed with Oxamine Developer B. (Dark shade.) | Oxamine Violet 
developed and developed with Alpha-Naphthol. |
| Sulphine A diazotised and developed with Beta-Naphthol and treated with a copper salt. | Oxamine Blue RRR diazotised and developed with Oxamine Developer B. (Dark shade.) | Cotton Black 3 B 
developed with Nitroamine solution and treated with Beta-Naphthol. (Light shade.) |
| Sulphine A + Cotton Black BN diazotised and developed with Beta-Naphthol. | Oxamine Blue RRR diazotised and developed with Beta-Naphthol. (Light shade.) | Oxamine Black N 
developed and developed with Beta-Naphthol, Oxamine Developer M, and soda. |
| Pyramine Orange 3G treated with Nitroamine solution. | Oxamine Violet 
developed and developed with Oxamine Developer B. (Light shade.) | Aniline Black. |

Sheet 9.
Silk.
The following kinds of silk are met with in the dye-house:

A. Raw silk of South European or Asiatic origin.

This is worked up into tram or organzine.

B. Schappe silk (chappe).

C. Tussah silk.

D. Floss silk.
Preparation of silk for dyeing.

A. Raw silk.

Silk is used in three conditions:

1. as "boiled-off" silk,
2. as souple silk,
3. as écru silk.

1. "Boiled-off" silk.

The stripping (ungumming, "boiling-off") takes place in the following manner:

A quantity of water sufficient for 20 lbs. of silk (80—120 gallons) is first softened by adding a little soda and then 6 lbs. of Marseilles soap are dissolved in it.

The silk is worked in this bath for \(\frac{3}{4} - 1\frac{1}{2}\) hours near the boiling point, i. e., at about 205° F.

From 1—1\(\frac{1}{2}\) lbs. of silk is placed on each rod and it is only turned once or twice during the process of "boiling-off." Care must be taken not to allow the bath to boil up again after the silk has been entered.

For yellow gum the silk is treated for \(\frac{3}{4}\) hour in a second bath which has a temperature of 205° F., and which only contains half as much soap as the first bath.

It is now rinsed in a lukewarm bath the water of which has been previously softened by adding a little soda, and finally rinsed in fresh cold water. After being hydro-extracted it is ready for dyeing.

The second of the above-mentioned soap baths is replenished by adding 3 lbs. of soap and then used for a further lot of silk.

The liquor after being fully used in this manner for "boiling-off" silk is called "boiled-off" liquor and constitutes a valuable addition to the bath when dyeing silk (this is described later on).
2. Souple silk.

The silk is wetted out and softened for \(\frac{3}{4}\) hour at 105 ° F. in a bath which contains 6 lbs. of Marseilles soap for every 20 lbs. of silk. It is then bleached with \textit{aqua regia}, or with gaseous sulphurous acid in cases where this bleach is sufficient.

It is then soupled for \(\frac{3}{4} - 1\) hour in

\begin{align*}
13 & \text{ oz. cream of tartar} \\
3\frac{1}{4} & \text{ sulphuric acid } 168^0 \text{ Tw.} \\
2\frac{1}{4} & \text{ pints of aqueous sulphurous acid.}
\end{align*}

The temperature employed varies between 130 — 165 ° F., according to the nature of the silk, the gum, and the after-treatment.

In many dye-houses the soupling is carried out by boiling in a hot solution of sulphurous acid alone.

The acid is finally removed from the silk by passing through one warm and one or two cold rinsing baths, after which the silk is hydro-extracted and dyed.

The quantity of \textit{aqua regia} which is used in the above bleaching process varies. A solution standing at 4 \(\frac{1}{2}\) ° Tw. may be regarded as of average strength.

In each case the silk is worked in the bleaching liquor until it has acquired a greenish tint. If it becomes slightly yellow, the action has gone too far and the silk cannot be used for several shades. The above-mentioned greenish tint disappears on rinsing sufficiently.

The bleaching with gaseous sulphurous acid takes place in stoving chambers. (This is described later on.)

3. Ecru silk.

The silk is well wetted out in lukewarm water or better still in a soap solution and then rinsed and dyed. The various processes are carried out lukewarm.

B. Schappe silk.

This is stripped for \(\frac{3}{4}\) hour at about 205 ° F. with a solution which contains 13 oz. to 1 lb. of calcined soda (or twice as much crystal soda) for every 20 lbs. of silk.

It should be turned as little as possible.

The silk is then worked for \(\frac{3}{4}\) hour in a second bath which contains 3 lbs. of Marseilles soap, after which it is thoroughly rinsed, hydro-extracted, and dyed.
As a rule the "boiled-off" liquor obtained from schappe silk as above described is not used for adding to the silk dye-baths. If, however, owing to scarcity of good "boiled-off" liquor, no other but this is available, then to get a useful liquor the silk should be boiled off as described under I, i.e., with 6 lbs. of Marseilles soap without an addition of soda. In this case the second bath is omitted.

If the "boiled-off" liquors from schappe silk are used for adding to the dye-bath, larger quantities are required than when working with those obtained from tram or organzine.

For white and other delicate shades the schappe silk is bleached before dyeing by means of gaseous sulphurous acid in stoving chambers or with hydrogen peroxide.

C. Tussah silk.

This kind of silk also requires two baths for boiling off. It is first treated for 1½ hours with 8 oz. of soda ash (or 1 lb. of crystal soda) and 1 lb. of Marseilles soap for every 10 lbs. of silk, and then for ¾ hour with 1½ lbs. of Marseilles soap. The temperature should be kept as near the boiling point as possible.

After "boiling-off" it is first rinsed lukewarm and then cold, &c.

For white or light shades Tussah silk is bleached with hydrogen peroxide. (Stoving does not suffice.)

D. Floss silk.

See page 255.
Methods of bleaching silk.

a) Bleaching by stoving.

The silk is soaked in a lukewarm weak soap bath and then wrung out and hung in the stoving chamber which should be filled as completely as possible with the hanging silk.

As a rule 1/2 lb. of sulphur is required each time for 10 lbs. of silk. If necessary the stoving process is repeated several times.

The acid is then removed by passing through several lukewarm rinsing baths and sometimes these are followed by a weak soap bath.

Better qualities of silk which are intended for white are usually stoved after dyeing, and the process is carried out as above described.

b) Bleaching with hydrogen peroxide, sodium peroxide.

(Mostly used for tussah, schappe silk, &c.)

For 10 lbs. of silk, for example, a bath is prepared from—

2 — 3 gallons of commercial hydrogen peroxide
3 1/4 — 4 1/2 gills of sodium silicate
1 — 1 1/2 lbs. of white soap (previously dissolved in about 12 gallons of water).

This bath is warmed up to 120 °F. and the silk is completely immersed in it for several hours. From time to time it is wrung out and turned.

If it is then not sufficiently bleached the process is repeated in the same manner.

After bleaching the silk is acidified in fresh water to which a little acid has been added, it is then rinsed in cold water.

The bleaching liquors are kept for further use, and if too weak they must be replenished as required.
When working with sodium peroxide the strongest bleach for 10 lbs. of silk is prepared from:

- 4½ lbs. of sulphuric acid
- 168° Tw.
- 5 lbs. 13½ oz. of sodium peroxide
- 15 gallons of water
- 4½ gills of sodium silicate
- 1½ lbs. of white soap.

For a weaker bleach ⅓ or ⅔ of the above-mentioned quantities are used.

In every case the sulphuric acid is carefully poured in a thin stream into the water which is continually stirred and then let cool completely. The sodium peroxide is now slowly added and dissolved but the other ingredients are only added just before the liquors are used.

The baths prepared in this manner can be used for a considerable time.

c) Bleaching with aqua regia.

See page 238.

Weighting of silk.

The following are the most important methods:

I. Before dyeing.
   a) Weighting with tin chloride.
   b) Weighting with phosphate of tin.
   c) Weighting with phosphate of tin and silicic acid.

II. After dyeing.
   d) Weighting with sumach extract or tannic acid. (This is often performed during the dyeing process.)
   e) Weighting with sugar, alone or in combination with magnesium salts.
a) Tin chloride method.

This consists of the following operations:

1. Lay the silk for 1 hour in a cold solution of tin chloride at 53° Tw. and then squeeze out.
2. Wash in the washing machine and hydro-extract.
3. Work for \(\frac{1}{4}\) hour in a lukewarm soda bath at 2° Tw.
4. Rinse in cold or lukewarm water.

The above treatment increases the weight of the silk at first by from 8—10%/o. If repeated, the increase is not so great.

If the silk requires to be heavily weighted, the process must be repeated several times, and in this manner the weight can be increased by 50%/o.

After the silk has been sufficiently weighted it is worked in every case in a hot soap bath for \(\frac{1}{4}\) hour. For 10 lbs. of silk this soap bath contains 3—7\(\frac{1}{2}\) lbs. of soap (i.e., 30—75%/o of the weight of the silk), the exact amount depending on the extent of the weighting. In several dye-houses the silk is previously worked for \(\frac{1}{2}\) hour in a lukewarm bath which contains 6\(\frac{1}{2}\) oz. of soda. This is intended to increase the lustre of the silk.

After rinsing the silk is brightened by turning it in water which contains a little hydrochloric acid.

b) Tin phosphate method.

This consists of the following operations:

1. Immersing in a tin chloride solution as in a.
2. Washing, &c., as in a.
3. Instead of being passed through a soda bath the silk is worked for \(\frac{1}{2}\) hour in a solution of sodium phosphate at 7\(\frac{1}{2}\)° Tw.; "boiled-off" silk is entered at 160° F. and souple silk at 120—140° F.
4. Rinse as in a.

Such a treatment increases the weight of the silk by about 20%/o. By repeating it sufficiently often the silk can be weighted up to 100%/o.

After it has been weighted enough the silk is passed into a strong soap bath and then brightened as described in method a.
c) Weighting with tin phosphate and silicic acid.

This process is carried out in exactly the same way as the one described under b, but a bath of sodium silicate at $4^{1/2}$° Tw. is introduced after the sodium phosphate bath. The silk is entered at a temperature of 140—160° F. into this bath and worked for $1/2$ hour.

Several dyers consider it better to treat the silk in this bath at a temperature of only 105—115° F. but then for one hour.

Under otherwise similar conditions the silk is weighted somewhat more by this process than by that described under b.

Considerable experience is required for working these processes, especially to avoid the silk being tendered. As a rule, if a considerable tendering results, it will have been caused by the silk having absorbed too much acid from the chloride of tin solution, from the dye-bath or from the brightening bath. The best way of preventing this is to avoid adding too much acid to the weighting bath and by thoroughly washing and soaping the silk. Further no more acid than is necessary should be used for brightening silk which has been weighted.

Weighted silk, however, requires a larger quantity of acid both in the dye-bath and in the brightening bath than unweighted silk.

d) Weighting with sumach (or tannic acid).

This can take place either after or during the dyeing process.

1. Weighting of “boiled-off” silk

to counteract the loss of 25—30% in weight caused by “boiling-off.”

The following method is used if the weighting has to take place after dyeing: —

The silk is dyed in the ordinary manner in an acid bath which contains “boiled-off liquor.” The change of shade, which may be slight or great, caused by
the action of the subsequent tannin bath, must be taken into account at this stage. The silk is next rinsed and entered into a boiling hot bath of sumach—or gall-nut—extract standing at 2° Tw. It is turned now and then in this bath until this has cooled down to 95—105° F., and finally rinsed in cold water and brightened.

If during the weighting process it is noticed that the silk has not the proper shade it can be corrected by adding suitable acid dyes to the tannin bath.

When used for very light shades the above process is frequently modified. The silk is not previously dyed but the colour and a little sulphuric acid are added to the weighting bath and the silk is dyed in this.

The tannin baths are used continuously, being brought up each time to the same degree Twadell by adding a sufficient quantity of extract.

Weighting of silk during the dyeing process.

The silk is dyed as near to shade as possible in an acid bath which contains "boiled-off" liquor and then sumach extract or gall-nut extract is added to the boiling liquid. The bath is now gradually allowed to cool down as described above, to 95—105° F., after which the silk is rinsed with cold water and brightened.

In order to avoid uneven dyeings, it is not advisable to use these old baths containing "boiled-off" liquor for more than two or three times.

It is by far the simplest to use fresh baths each time.

2. Weighting of souple silk.

The weighting after dyeing is carried out in exactly the same way as described for "boiled-off" silk, but a solution of sumach extract varying from 3—9° Tw., according to the weighting required, is used. The tannin baths are kept to be used again for similar shades after replenishing each time with suitable additions of sumach extract.

In many cases the dyeing takes place in the sumach extract bath for which purpose acid dyes are used and a little sulphuric acid is added to the bath.
e) Weighting with sugar.

This method is almost exclusively used for souple and also to a certain extent for sewing silk in order to increase the weight by a few percent.

After the silk has been dyed, brightened, and hydro-extracted it is worked in handfuls in a sugar solution at 60° Tw. after which it is wrung out and then shaken out.

Loaf sugar is generally used for this purpose and, if necessary, it can be purified by boiling with the yolk of a few eggs.

Grape sugar can also be used for dark shades.
Dyeing of Silk.

Apparatus for dyeing.

a) Silk hanks.

Small lots are dyed in copper boilers and large quantities in copper or in copper-plated vats. These are mounted on wheels so that with the exception of the long heavy vats, they can be moved about in the dye-house. This arrangement is a desirable one as the dyer requires to use smaller or larger vats according to the quantity of silk which has to be dyed at one time.

These vessels are frequently used for the most various shades and it is often necessary to cleanse them thoroughly. For this purpose they are first boiled out with old “boiled-off” liquor from schappe silk, or the inner walls are thoroughly scoured with a hot strong solution of soda. After this has been run off and the vat has been rinsed out, it is generally cleansed with dilute sulphuric acid and then rinsed out with water.

The larger vats which are stationary are frequently warmed by a steam-coil that lies on the bottom, but in most cases movable steam pipes are inserted.

The latter are always used for small vats and are fitted in various positions in the dye-house. These steam pipes can be turned in a ball and socket joint and for the sake of convenience they are fitted with a steam pipe which can be fixed on by means of a bayonet coupling and through which the steam can be passed directly into the vat.

The silk is dyed on smooth rods in the same manner as wool. As a rule 2 1/2 lbs. of unweighted silk are distributed on to four sticks, but if the silk is weighted 5 — 6 sticks will be necessary.
Silk. Methods of dyeing.

b) Piece-goods.

Finer qualities of silk piece-goods and also plush are woven with dyed silk. If ordinary silk cloth is to be dyed in the piece it is done in a wooden vat fitted with a hand winch.

The piece which has to be dyed is not stitched end to end, but runs free over the winch and as soon as one end appears it is run back in the same manner, and so on.

The other details of the dyeing process are the same as when dyeing silk hanks.

Preparing of the dye-vat.

1. Working in an acidified bath containing "boiled-off" liquor.

In preparing such a vat \(\frac{1}{5} - \frac{1}{4}\) of the whole liquid should consist of "boiled-off" liquor (about 10—15 gallons are required for 10 lbs. of silk). Dilute sulphuric acid (or acetic acid, tartaric acid) is added to the vat until the "boiled-off" liquor no longer froths and has a slightly acid taste. This is known as breaking the "boiled-off" liquor and the use of such a slightly acidified bath we will indicate as method 1a.

If the dyeing is carried out in a bath to which a considerable excess of acid has been added and which is therefore distinctly acid, we will call it method 1b.

The liquor prepared as above described is in both cases next diluted with water (about 30—45 gallons) and warmed up to 105° F. and the silk is entered and turned in it several times. It is then taken out, the necessary amount of colour solution is added and stirred up.

The silk is again entered and quickly turned 5—7 times. The bath is now warmed up to 140° F. and later on to the boil, the silk being taken out of the bath each time the temperature is raised.

The shade is now examined, and if necessary more colour solution is added. After each of these additions it is advisable to raise to the boil, for then it is certain that the lot will be evenly dyed and that the shade will not change again on heating up.
Of course, if the liquors are raised to the boil too often the silk will suffer, and one must therefore try to make a few times suffice.

When working with colours which dye evenly at 120—140° F., it is not necessary to raise to the boil.

The method 1a (weak acid bath) is used for dyeing with the colours of the Eosine group and for most basic dyes. (It can also be used for Diamond Magenta).

The method 1b (distinctly acid bath) is used for most acid dyes, the Spirit Blues, and for many substantive dyes.

2. Dyeing in a slightly alkaline or neutral bath which contains "boiled-off" liquor.

The Alkali Blues, Soluble Blues, and several basic and substantive dyes are dyed according to this method.

3. Dyeing in a bath which contains a small quantity of Marseilles soap.

The chief item necessary for producing a good soap bath is soft water. If such cannot be obtained, the lime contained in hard water can be rendered innocuous by previously correcting it with a little soda.

In both cases Marseilles soap is added until the bath froths distinctly. As a rule $\frac{1}{4} - \frac{3}{4}$ oz. of soap is required per gallon.

The silk is entered into this soap bath at the boil and worked for some time near to the boiling point.

Finally the soap must be completely removed from the silk by washing. This can be carried out in the washing machine or by using several fresh lots of water, to the first of which a trace of soda is added.

Amongst others the following are dyed on "boiled-off" silk in a boiling hot soap bath:—All white shades, yellow shades with Nitrosamine Red in paste, Saffranine. (This method is also extensively used for Diamond Magenta and Alkali Blue. The colours of the last group must, of course, be well brightened afterwards.)
4. **Dyeing in a bath which is acidified with acetic acid**

*(without “boiled-off” liquor or soap).*

Enter the silk lukewarm, gradually raise the temperature to 140° F. and then to 175° F., and add acetic acid until the bath exhausts sufficiently. Now finish dyeing by raising once or twice to the boil.

This method is used for grounding with acid dyes such as *Azoflavine S, Orange II, Fast Red,* &c. It is used if possible in all cases when “boiled-off” liquor cannot be obtained or at least not in sufficient quantity.

Many of the basic dyes are also dyed in this manner. In the latter case the acetic acid is not required to cause the colour to exhaust but it helps to produce level dyeings and to give the silk a soft feel. In such cases the silk is generally entered into a cold bath which contains about 8 oz. of acetic acid per 100 gallons of water. The colour solution is added in several portions, the silk is well turned and the bath is then heated up to 175° F. Silk which has been dyed in this manner does not require to be brightened.

The colours of the *Eosine* group are also dyed according to this method, No. 4. These colours dye evenly at 120—140° F., and it is therefore not necessary to heat up any higher. The acetic acid can also be added to the vat at this temperature.

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5. **The dyeing of previously mordanted silk.**

As a general rule this method is only used for the Alizarine or wood colours. At the present time our *Dark Green paste* is the only Aniline colour which is dyed according to this method.

In order to produce fast brown shades with this colour the silk is laid overnight in chromium chloride 32° Tw. B.A.S.F., wrung out and well washed, if possible in running water. It is then fixed in a bath of sodium silicate and again thoroughly rinsed.

The silk is now dyed with 5—10 lbs. of *Dark Green paste* (for 100 lbs. of silk), 1/2—1 lb. of calcium acetate being added to the bath. The silk is entered cold and the bath is then gradually raised to 175° F.

Finally rinse well and brighten as usual.
For producing very fast dark green shades with the *Dark Green paste* the silk is laid overnight in nitrate of iron 23—32° Tw. It is then wrung out and very thoroughly rinsed, if possible in running water.

Now dye exactly as described above with 5—10 lbs. of *Dark Green paste* and \( \frac{1}{2} \) 1 lb. of calcium acetate (for 100 lbs. of silk), rinse well and brighten.

It is hardly possible to formulate general rules regarding the choice of colours for dyeing silk. The silk dyer does not limit himself to any particular group of colours, except when special demands are made with regard to fastness (e.g., fastness to water) which makes it necessary to use certain products. Basic, acid, or spirit soluble colours are used, whichever appear suitable for his special case. The silk is often ground with acid dyes and topped with basic dyes or both are even used at the same time.

The methods described below for producing current shades may serve to illustrate this.

**White.**

This is best dyed in a bath which contains a moderate quantity of Marseilles soap. The silk is entered at the boil and dyed with *Parme soluble in spirit*; if necessary, it can be shaded towards green with the *Spirit Blue* brands.

The shade is examined by taking out a small piece of silk and brightening it in a lukewarm, weak acid bath. If the shade developed in this manner agrees with the pattern, the dye-bath is raised to the boil so as to produce even dyeings. The silk is turned several times, taken out, wrung out or hydro-extracted and stoved. The sulphurous acid is now removed as described on page 228 and the silk is brightened in a lukewarm bath which contains a little sulphuric acid.

**Light Blue** (sky blue, &c.).

Such delicate shades as these are best dyed with one of the finer *Alkali Blue* brands (e.g., *Alkali Blue 6 B, Methyl Alkali Blue*). A small quantity of Marseilles soap is added to the bath and the silk is entered at the boil. The sampling is carried out as above described for white treating the test-piece of silk thoroughly with acid. After the correct shade has been obtained, the soap is removed from the whole lot either in the washing machine or by rinsing several times in cold water. It is then developed, at 140—175° F. or at the boil, in water which has been strongly acidified with sulphuric acid.

After this it is generally brightened in a cold, weak acid bath. If necessary, during this operation one can shade off with a bluish basic *violet* or with a basic *green*. 
Silk. Methods of dyeing. Practical examples.

Dark Blue.

This can be dyed with *Alkali Blue* in a bath which contains a small quantity of Marseilles soap or in an acidified "boiled-off" liquor bath with *Victoria Blue*, *Silk Blue B*, or *Soluble Blue*.

Navy Blue.

These shades are often dyed in a soap bath with *Alkali Blue*. Wooden vats are used for this purpose and the liquors can be reserved for further use.

After acidifying the dyeing is completed in an acidified "boiled-off" liquor bath with *Azoflavine* (or *Orange N*) and *Methyl Violet* (or indeed with basic greens, New Blue S, &c.). In this case the yellow is first added and the basic colours are added later on.

It is advisable in order to obtain level dyeings to warm up slowly and then to raise several times to the boil.

Another method of producing navy blues is to dye direct with *Silk Blue B* in an acidified "boiled-off" liquor bath.

The silk is entered at 105° F., well turned, warmed up to 140° F. and turned. *Azoflavine* is now added in order to darken the shade, the silk is well turned and again warmed up to 140° F. when the basic violet is added. Finally raise to the boil which causes the blue to gradually exhaust.

For navy blues which are empty overhand, the silk is often grounded with *Induline NN* in an acidified "boiled-off" liquor bath which is slowly warmed up and finally brought to the boil. If desired one may dye without "boiled-off" liquor and even without at first adding acid.

In the latter case the silk is entered into a lukewarm bath which is warmed up to 140° F. The silk is then taken out, the bath is raised to 175° F. and acetic acid is added. Finally it is brought to the boil.

The shading with basic dyes takes place in a fresh bath which contains acidified "boiled-off" liquor.

Red.

The various red and scarlet shades can be produced with quite a large number of dyes. They are dyed direct in a bath containing "boiled-off" liquor which has been acidified with tartaric or sulphuric acid.

Amongst others the following products are extensively used: — *Silk Red N, G, R, Scarlet R—RRR, Cochineal Red A, Fast Scarlet B.*
For cardinal and garnet shades the silk can be grounded with Orange II, Fast Red AV, &c., without using "boiled-off" liquor. The silk is entered into the lukewarm dye-bath without an addition of acid, it is gradually warmed to 140° F. and then to 175° F., after which acetic acid is added until the bath exhausts sufficiently.

After having raised the bath once or twice to the boil the shade will be sufficiently even. It is then topped with basic dyes in a fresh acidified bath to which "boiled-off" liquor has been added.

In order to produce the necessary bloom a sufficient quantity of Diamond Magenta or Magenta Powder A must generally be used.

Brown.

For brown shades it is also advisable to first ground the silk and for this purpose Orange N, Azoflavine, &c. are used, either alone or in combination with Fast Red AV.

In this case also no "boiled-off" liquor is used and the necessary amount of acetic acid is added shortly before the bath is raised to the boil.

The dyeing is then finished off in an acidified bath containing "boiled-off" liquor by means of Fast Red, Acid Violet, Light Green, &c.

Black.

The black dyeing of silk is still distinctly a speciality, and there are many firms who treat it as a thing apart from the dyeing of colours and devote themselves exclusively to it.

The methods employed always depend in principle on the use of tannin substances, iron mordants, and wood colours. In many cases Prussian Blue is simultaneously produced on the fibre.

It is therefore not necessary to describe the process more fully here, but we might mention that Alkali Blue is used in many cases in place of the above-mentioned Prussian Blue.

Black Aniline dyestuffs can be used for producing blacks which do not require to be specially beautiful or full and which must be produced in a quick and simple manner.

Amongst these our Palatine Black 4 B is especially suitable and a good black can be obtained with 10—15% of colour. For a deep black it is shaded off with Azoflavine.

This product is dyed at the boil according to method 4, but the acetic acid can be replaced by sulphuric acid. The dye-bath exhausts sufficiently.
Brightening of silk.

After dyeing, the silk is generally rinsed in one or two lots of cold water. It is then brightened in a bath which has been slightly acidified with sulphuric or acetic acid. (Tartaric acid is frequently used for this purpose for Rhodamine.)

For weighted silk a little olive oil emulsion is generally added to the brightening bath. For 20 lbs. of silk $\frac{1}{2}$—1 lb. of olive oil is well boiled up with some soda and a little water and added to the bath. The silk must be entered as soon as this has been added to the bath or else the oil will begin to separate out again.

For schappe silk which is intended for velvet the acid brightening bath is replaced by a so-called softening bath. The dyed silk is passed through two lots of water and then into a fresh bath to which a little acetic acid and a small amount of the following preparation has been added:—A solution of 55 lbs. of alum is slowly stirred into a solution of $16\frac{1}{2}$ lbs. of calcined soda (or 33 lbs. of crystal soda). The total quantity of water used should equal 176 gallons.

If during the long treatment which is necessary for heavily weighting the silk some parts of the fibre have become loose, it is usual in many dye-houses to add $\frac{3}{4}$ lb. of glue to the brightening bath to fix them together again.

Finishing.

With tram silk and tussah silk it is well to work on the lustring machine after drying as this improves the lustre considerably.

Souple silk is glossed on the machine or on rods after drying. This imparts to it the requisite softness and lustre.
Silk. Suitable dyestuffs.

The following colours are extensively used for dyeing silk:

**Acid dyes:**


**Basic dyes:**


**Eosine dyes:**

All Eosine, Erythrosine, Phloxine, and Rose Bengal brands.

**Substantive dyes:**

All substantive dyes including those which are developed on the fibre.

**Mordant colours:**

Dark Green in paste.

**Spirit colours:**

Dyeing of Floss Silk.

Floss silk is met with in the dye-house in the loose condition and also as yarn. In most cases it has a dirty grey to yellowish brown colour which is affected so little by boiling with soap, soda, &c., that it is advisable to dispense with such treatment.

It is always dyed according to method 4 (without "boiled-off" liquor in a bath which is acidified with acetic acid).

If the liquors do not exhaust sufficiently a little sulphuric acid is added towards the end of the dyeing process.

If, when dyeing thick yarn, difficulty is encountered with regard to penetration, it can also be overcome by increasing the quantity of acid used when dyeing.

Dyestuffs of all groups may be used, but in each case one must take into consideration the purpose for which the silk is intended when choosing them.

The basic dyes are used wherever possible when it is not necessary for the colours to be fast.

If, however, the silk is intended for decorative threads for woollen piece-goods, it must generally be fast to milling. The brightness of shade which is also required in such cases not only necessitates the use of bright colours but also of a sufficiently white material to commence with.

The following colours which are sufficiently fast to milling with regard to bleeding into white cotton, wool, or silk should be tried:—


If the colours need not be fast against bleeding into white cotton, the various substantive dyes may be used, either as such or after treatment with copper salts on the fibre.
Silk. Dyestuffs for dyeing Floss Silk.

The following are also suitable for dyeing Floss silk and are extensively used:—


These products should be tested in each case to see if they are fast enough for the purpose in question.
Artificial Silk.

Artificial silk is very difficult to dye as it absorbs the dyestuffs very rapidly, and it has therefore a great tendency to dye unevenly. It also varies according to the method of manufacture, and even different lots from the same works may vary more or less in their behaviour in the dye-bath.

For example, the so-called Glanzstoff has dyeing properties which are similar to those of mercerised cotton and therefore the most important colours for this product are the substantive dyes. When dyeing dark shades with basic dyes the material must be previously mordanted. Acid dyes have no affinity for this substance.

On the other hand the dyeing properties of “Chardonnet Silk” are more similar to those of natural silk. Substantive dyes are indeed the most suitable for this product also, but the basic dyes are also well adapted as without previous mordanting a number of shades can be produced with them.

“Chardonnet Silk” can also be dyed light shades with the acid colours.

Method of working with substantive dyes.

They are generally dyed in a slightly acidified hot bath with an addition of nothing but Glauber’s salt. The temperature is only raised to 140° F. or higher when absolutely necessary as this has an unfavourable influence on the lustre of the material. If it is found difficult to obtain level dyeings adopt the precaution that is used in cotton dyeing, i.e., add a little soap, soda, or Turkey-red oil to the dye-bath.
The following substantive dyes are specially adapted for dyeing Glanzstoff or Chardonnet Silk:


Method of working with basic dyes.

The silk is dyed with these colours in a bath which has been slightly acidified with acetic acid according to the principles of method 4, page 249. The silk is, however, entered cold and raised slowly to 120°F. For dark shades a previous mordanting with tannin and tartar emetic is necessary especially when working with Glanzstoff.

The following products are suitable for this purpose:


Method of working with sulphur dyes (Kryogene Black B, &c.).

The dyeing process is similar to that which is used for cotton with the exception that it is effected at a lower temperature, e.g., 140—160°F. (See process page 153.) The after-chroming and brightening can generally be omitted.

Copper boilers must not be used when working with these colours.
Method of working with acid dyes.

Only used for a few light shades on Chardonnet Silk. Dye in a hot bath with an addition of acetic acid.

The following products are suitable for this purpose:—

Pattern-Sheets.

Silk.
Silk.
Dyed with acid dyes.

<table>
<thead>
<tr>
<th>Quinoline Yellow</th>
<th>Silk Red R.</th>
<th>Methyl Soluble Blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naphthol Yellow S.</td>
<td>Azocarmine G.</td>
<td>Fast Blue 5 B.</td>
</tr>
<tr>
<td><em>Azoflavine S.</em></td>
<td>Acid Magenta S.</td>
<td>Fast Blue R.</td>
</tr>
<tr>
<td>Azoflavine FF.</td>
<td>Acid Violet 4 R.</td>
<td>Induline N.N.</td>
</tr>
<tr>
<td>Azoflavine RRR.</td>
<td>Red Violet 4 RS.</td>
<td>Nigrosine W.</td>
</tr>
<tr>
<td>Orange II.</td>
<td>Acid Violet 3 BN.</td>
<td>Palatine Black 4 B.</td>
</tr>
<tr>
<td>Orange X.</td>
<td>Acid Violet 6 BN.</td>
<td>Palatine Black 6 BE.</td>
</tr>
<tr>
<td>Silk Red G.</td>
<td>Alkali Violet 6 B.</td>
<td>Wool Blue S.L.</td>
</tr>
<tr>
<td>Fast Scarlet GGN.</td>
<td>Pure Blue I.</td>
<td>Neptune Green S.B.</td>
</tr>
<tr>
<td>Fast Scarlet B.</td>
<td>Silk Blue B.</td>
<td>Bluish Green S.</td>
</tr>
<tr>
<td>Sorbin Red.</td>
<td>Alkali Blue 5 B.</td>
<td>Wool Green S.</td>
</tr>
<tr>
<td>Fast Red AV.</td>
<td>Alkali Blue B extra.</td>
<td>Light Green SF yellow shade.</td>
</tr>
</tbody>
</table>
Silk.
Dyed with **basic** dyes.

<table>
<thead>
<tr>
<th>Stain</th>
<th>Color Description</th>
<th>Color Name</th>
<th>Supplement Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auramine II</td>
<td>Saffranine T extra.</td>
<td>Victoria Blue 4 R.</td>
<td></td>
</tr>
<tr>
<td>Rheonine N.</td>
<td>Rubine N.</td>
<td>Victoria Blue B.</td>
<td></td>
</tr>
<tr>
<td>Rheonine A.</td>
<td>Cerise D.IV.</td>
<td>Night Blue.</td>
<td></td>
</tr>
<tr>
<td>Phosphine N.</td>
<td>Diamond Magenta II small crystals.</td>
<td>Nile Blue R.</td>
<td></td>
</tr>
<tr>
<td>Chrysoide A.</td>
<td>Diamond Magenta I small needles.</td>
<td>Methylene Blue B.</td>
<td></td>
</tr>
<tr>
<td>Chrysoide T.</td>
<td>Saffranine M.N.</td>
<td>Nile Blue A.</td>
<td></td>
</tr>
<tr>
<td>Cannelle</td>
<td>Red Violet 5 R extra.</td>
<td>Nile Blue B.B.</td>
<td></td>
</tr>
<tr>
<td>Vesuvine 000 extra.</td>
<td></td>
<td>Iris Violet.</td>
<td>Diamond Green B.</td>
</tr>
<tr>
<td>Vesuvine B.</td>
<td>Methyl Violet R.R.</td>
<td>Diamond Green G.</td>
<td></td>
</tr>
<tr>
<td>Rhodamine 6 G.</td>
<td>Methyl Violet B.B.</td>
<td>Dark Green paste. (Mordant dye.)</td>
<td></td>
</tr>
<tr>
<td>Rhodamine G.</td>
<td>Crystal Violet.</td>
<td>Indone Blue B.B powder.</td>
<td></td>
</tr>
<tr>
<td>Rhodamine B.</td>
<td>Ethyl Purple 6 B.</td>
<td>Jet Black.</td>
<td></td>
</tr>
</tbody>
</table>
Silk.

Dyed with **substantive** dyes.

<table>
<thead>
<tr>
<th>Sulphine A.</th>
<th>Thiazine Brown G.</th>
<th>Oxamine Garnet M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton Yellow G.I.</td>
<td>Thiazine Brown R.</td>
<td>Cotton Corinth G.</td>
</tr>
<tr>
<td><em>Carbazol Yellow</em></td>
<td>Copper Brown.</td>
<td>Oxamine Maroon.</td>
</tr>
<tr>
<td>Cotton Yellow R.</td>
<td>Cotton Brown R.N.</td>
<td>Oxamine Violet.</td>
</tr>
<tr>
<td>Cotton Yellow GRR.</td>
<td>Cotton Brown R.V.</td>
<td>Oxamine Blue R.R.R.</td>
</tr>
<tr>
<td>Cotton Orange G.</td>
<td>Oxamine Brown M.N.</td>
<td>Violet Black.</td>
</tr>
<tr>
<td>Cotton Orange R.</td>
<td>Cotton Red 4 B.</td>
<td>Oxamine Blue R.N.</td>
</tr>
<tr>
<td>Yellow from Nitrosamine Red in paste.</td>
<td>Thiazine Red G.</td>
<td>Phenamine Blue R.</td>
</tr>
<tr>
<td>Pyramine Orange 3G.</td>
<td>Thiazine Red R.</td>
<td>Oxamine Blue B.</td>
</tr>
<tr>
<td>Salmon Red.</td>
<td>Cosmos Red.</td>
<td>Phenamine Blue G.</td>
</tr>
<tr>
<td>Pyramine Orange R.</td>
<td>Oxamine Red.</td>
<td>Oxamine Green M.N.</td>
</tr>
<tr>
<td>Pyramine Orange RR.</td>
<td>Oxamine Claret M.</td>
<td>Cotton Black B.N.</td>
</tr>
</tbody>
</table>
Silk.
Dyed with substantive dyes which are developed on the fibre.

<table>
<thead>
<tr>
<th>Sulphine A diazotised and developed with spirit.</th>
<th>Oxamine Blue R.R.R diazotised and developed with Beta-Naphthol.</th>
<th>Oxamine Violet diazotised and developed with Oxamine Developer M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphine A diazotised and developed with Beta-Naphthol.</td>
<td>Oxamine Blue R.R.R diazotised and developed with Oxamine Developer B.</td>
<td>Oxamine Blue R.R.R diazotised and developed with Oxamine Developer B.</td>
</tr>
<tr>
<td>Sulphine A diazotised and developed with Oxamine Developer B.</td>
<td>Oxamine Blue R.R.R diazotised and developed with Oxamine Developer B.</td>
<td>Oxamine Blue R.R.R diazotised and developed with Oxamine Developer B.</td>
</tr>
<tr>
<td>Sulphine A diazotised and developed with Oxamine Developer M.</td>
<td>Oxamine Violet diazotised and developed with Oxamine Developer B.</td>
<td>Oxamine Violet diazotised and developed with Oxamine Developer M.</td>
</tr>
</tbody>
</table>

Silk.
Dyed with colours of the Eosine group.

<table>
<thead>
<tr>
<th>Eosine A.</th>
<th>Erythrosine extra yellowish.</th>
<th>Phloxine H.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eosine M.L.</td>
<td>Erythrosine IN.</td>
<td>Phloxine BBN.</td>
</tr>
<tr>
<td>Eosine BN.</td>
<td>Phloxine GN.</td>
<td>Rose Bengal NT.</td>
</tr>
</tbody>
</table>

Silk.
Dyed with spirit colours.

<table>
<thead>
<tr>
<th>Quinoline Yellow soluble in spirit.</th>
<th>Spirit Blue T.</th>
<th>Nigrosine G soluble in spirit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parme soluble in spirit.</td>
<td>Spirit Blue II.</td>
<td>Japan Black extra.</td>
</tr>
<tr>
<td>Spirit Blue R.R.</td>
<td>Indoline N soluble in spirit.</td>
<td>Japan Black M.</td>
</tr>
</tbody>
</table>
Preparation of pieces consisting of silk and cotton for dyeing.

The various pieces which are to be dyed together are first marked by stitching in a number. They are then sewn evenly together before singeing and boiling out.

The pieces are passed several times through a gas-singeing machine so that each side is singed 2—4 times, depending upon the quality of the material.

Recently it has become usual to boil out in a special apparatus which is similar in construction to a jigger. The material is unwound from one roller and passed through the liquor, which is contained in a rather deep and large box, past a system of rollers, and is then wound up on the other side on to another roller. From this it passes back again on to the first roller in the same way.

In addition to this special boiling-out apparatus various vats are used in which the material can be thoroughly rinsed with sprays and running water.

**First boiling-out bath.**

For each lot of 90—130 lbs. of material a bath is prepared with 45—55 lbs. of Marseilles soap. If the water which is used is hard, it must be previously corrected with a little soda. This bath is kept near the boiling point and the goods are passed through it for 1 1/2—2 hours.

If a further lot of material is to be passed through the same bath it is replenished with 9—11 lbs. of Marseilles soap.

From the first boiling-out bath the pieces run over a guiding roller which is placed between, but high above, the apparatus into a

**second boiling-out bath.**

This contains a solution of 22 lbs. of Marseilles soap, or, at first only 11 lbs. of soap are added to the bath and then it is replenished for each following lot with 1—2 lbs. more.

The pieces are allowed to run in this liquid for 1/4—1/2 hour.
Materials consisting of silk and cotton. Preparation for dyeing.

After this the material is passed through a hot soda bath at 160° F. This is kept slightly alkaline, i.e., a little more soda is added than is necessary to precipitate the lime which is present in most water and the goods are only passed once through. This bath serves principally to remove the soap from the pieces and to prevent the formation of lime soaps in the subsequent rinsing baths.

From this the pieces pass into the first Rinsing bath where they are subjected to a thorough rinsing.

They are now run into an Acid bath which serves to increase the lustre of the silk. The water in this bath has a temperature of 160° F. and contains enough sulphuric or hydrochloric acid to give it a slightly acid taste.

This is followed by a Rinsing bath which is supplied with running water if possible.

We might here mention a new method for which we have applied for a patent, the object of which is to strip the silk in the piece by treating the material with a cold solution of caustic soda and grape sugar.

Those who are interested in this process are referred to our special recipe.
Apparatus for dyeing materials consisting of silk and cotton.

For this purpose ordinary dye-vats fitted with winches and also jiggers are used. They have the same construction as those which are used for cotton piece-goods.

The dye-vats with winches are preferred, as more even dyeings are obtained and the material does not suffer as much. The lists of the pieces are generally sewn together. On the jigger they are of course dyed in open width.
Methods of dyeing.

A. Dyeing on a tannin mordant.

This process is used in those cases where the required shade cannot be produced sufficiently bright and full with substantive dyes.

The principles of dyeing the silk and then mordanting and dyeing the cotton are the same as when working with pure cotton or silk piece-goods. One must, however, take into consideration the fact that the shade of the silk is more or less dulled when dyeing the cotton, the experience being similar when dyeing unions consisting of cotton and wool in several baths. It also frequently happens that the cotton is stained when dyeing the silk. (How to avoid this as far as possible and how to overcome both difficulties, see notes.)

The cotton is always required to be darker than the silk, so that attention must be given to this point also.

The following description of how certain current shades can be produced will explain the method of working.

Magenta on 100 lbs. of material.

Dye the silk according to process 4, page 249, with

2 lbs. Acid Magenta S.

Rinse slightly, mordant the cotton cold with

8 lbs. tannic acid

and add a little hydrochloric acid to the mordanting bath, bearing in mind the rules given on page 289. (Dyeing of unions in several baths.)

Rinse very lightly and pass through a cold bath containing

4 lbs. tartar emetic.

Now rinse thoroughly and dye in a cold bath which contains a little acetic acid and

$\frac{3}{4}$ lb. Diamond Magenta I small needles.

Finally rinse thoroughly and hydro-extract.
Shot effect (green and red) on 100 lbs. of material.

Dye the silk according to process 4, page 249, with

4 lbs. Quinoline Yellow
1 lb. Light Green SF yellow shade.

Mordant as described above with

10 lbs. tannic acid
4 » tartar emetic.

Finally dye cold with

1 lb. Saffranine XX
1 » Auramine II

adding a little acetic acid to the bath.

Notes.

1. If the silk absorbs too much of the colour which is intended for the cotton, the material has been mordanted hot, the rinsing after the tartar emetic or tannic acid baths has been omitted, or the dyeing has been effected at too high a temperature. The same effect is also produced if too little acid is added to the dye-bath. In cases where this difficulty is encountered the original clear shade can sometimes be reproduced by working in a cold soap solution.

2. If the cotton remains too light (or if the colour does not exhaust sufficiently under the above conditions of working) the tannin mordant must have been too weak. It is frequently overlooked, especially when working on the winch, that this is not entirely dependent on the amount of tannic acid used, but that the concentration of the liquors also plays an important part. If the solution is too dilute, the tannic acid is only slowly and incompletely exhausted.

   A further reason for cotton absorbing the colour badly may of course be that it is not sufficiently matured.

3. If the cotton has been stained too much whilst dyeing the silk, it can sometimes be cleared by working it in a weak solution of bleaching powder. Finally sour in the cold, rinse, and mordant.

4. If the silk appears bronzy after dyeing it may be due to the use of hard water, or to the goods containing soap, or to over-dyeing (i.e., using too large a quantity of colour.)

   In the last two cases the remedy is self-evident. When working with colours which are sensitive to hard water or which have a tendency to bronze (Diamond Green, Methyl Violet, Victoria Blue) a sufficient amount of acetic acid or better still a trace of hydrochloric acid, should be added.
B. Dyeing with substantive dyes and topping if necessary with basic dyes.

In this method of working those colours are generally used which dye the cotton a full shade in an alkaline bath and which leave the silk light. The latter is then dyed up to the required shade in a fresh bath with basic dyes (or basic and acid dyes).

Another method is to first dye the silk in an acid bath and then to dye the cotton in a lukewarm soap bath with substantive dyes.

In some cases the substantive dyes are also used to dye the silk and then those products are chosen which have a tendency to dye the latter a full shade.

The extent to which the silk is dyed can be regulated by varying the conditions of working, e.g., the silk can be caused to dye fuller by adding Glauber's salt and by reducing the amount of soda used in the process which is described below.

Several shades can be dyed in one bath by using a combination of acid and substantive dyes.

The number of acid dyes which dye silk in an alkaline bath is, however, limited and includes, for example: — The Fast Red and Azo flavine brands. Alkali Violet. Rhodamine B, G, 3 B. The Alkali Blue brands. (The latter, of course, require to be brightened after dyeing, see page 250.)

The following is an example of the most important method of working, i.e., dyeing in an alkaline bath and topping with basic dyes.

Lilac on 100 lbs. of material.

Ground the cotton for 1 hour near the boiling point with

\[2 \frac{1}{2} \text{ lbs. Oxamine Blue } RRR\]

in a bath to which has been added

\[6 \text{ lbs. soap}\]

\[2 - 2 \frac{1}{2} \] calcined soda (or twice this amount of crystal soda).

Rinse once lukewarm and once cold and dye the silk in a fresh cold bath with

\[9 \frac{1}{2} \text{ oz. Crystal Violet}\]

\[6 \frac{1}{2} \] Methylene Blue MD.

A little hydrochloric acid is added to the bath to prevent the Crystal Violet from rubbing off (bronzing).

For basic colours which are not so sensitive acetic acid is sufficient.

Example.

Shot effect (yellow and violet) on 100 lbs. of material in one bath.

Dye for 1 hour near the boiling point with

\[
\begin{align*}
2 \text{ lbs. } & \text{Azoflavine } R S \\
1/2 \text{ } & \text{Oxamine Violet}
\end{align*}
\]

with an addition of

\[
\begin{align*}
5 \text{ lbs. soap} \\
3 \text{ } & \text{soda crystals.}
\end{align*}
\]

Rinse, &c.

Notes.

1. Wherever possible, the dyer of materials consisting of silk and cotton does well to avoid using Glauber's salt in an alkaline soap bath. In some cases, however, this cannot be avoided, e.g., when dyeing cotton and silk at the same time with substantive dyes, and also in many cases when the cotton has to be dyed a very full shade.

When grounding with substantive colours in the soap bath the soda can be partially replaced by phosphate of soda. The advantage of this method is that the silk is not injured so much when working in old liquors.

In place of 2% soda, use for example 1/4% soda and 2% phosphate of soda.

2. For dark shades and such as are difficult to dye even, the silk is indeed also dyed in presence of "boiled-off" liquor. This is, however, risky, as it can easily give rise to the formation of light blotches, especially if the "boiled-off" liquor is old.

3. If the pieces consisting of silk and cotton have not been carefully boiled out and lime soap is present, spots will appear when the goods are dyed or dried. It is very seldom that these can be completely removed.

4. The reasons for the bronzing of silk have already been considered in method A, note 4, page 267.
Polishing and finishing of materials consisting of silk and cotton.

After rinsing, the pieces are dried in the drying room, or, better still, on the machine, after which they are examined and polished. The latter operation is done with a rag, or with the palm of the hand, moistened with a mixture of oil and benzine.

The pieces are then finished. If necessary they are again singed, after which they are treated with a preparation which consists chiefly of gum tragacanth with additions of dextrine, glue, olive oil, glycerine, or similar substances. This mixture should be as neutral as possible. After this the pieces are immediately passed on to the drying cylinders, they are then brushed (some goods are also steamed), calendered, and, if necessary, again brushed and pressed whilst warm.

The following dyestuffs are used for dyeing materials consisting of cotton and silk according to method A:

All basic and acid dyes which are used for dyeing pure silk or cotton.

When working according to method B, the following colours are extensively used for topping:

\textbf{Auramine II.} \textbf{Vesuvine OOO extra. Rhodamine S, 6G, B.}
\textbf{Saffranine T extra, MN. Crystal Violet. Methylene Blue BH.}
\textbf{Diamond Green B} and \textbf{G, &c.}

Amongst the substantive dyes the following are especially suitable, as they dye a full shade on cotton in an alkaline bath and leave the silk light:

\textbf{Cotton Yellow G, GI, R. Cotton Red 4B. Pyramine Orange R.}
\textbf{Oxamine Dark Blue M. Oxamine Green M. Oxamine Dark Green M. Cotton Black B, BN.}
Materials

consisting of

Silk and Wool.

(Gloria, &c.)
Preparation of materials consisting of silk and wool for dyeing.

The preparation of many materials of this kind (e.g., gloria, bengaline, &c.) requires great experience. The details of the process also vary to a great extent depending upon the structure of the material so that we cannot describe them here.

We might, however, mention that after the pieces have been singed they are treated for some time with hot water, i.e., the so-called crabbing.

The pieces always pass in the open width or in the stretched condition from the singeing roller to a second roller. They are not only passed through boiling hot water, but also through one or several pressing arrangements, the pressure of which can be regulated as desired.

After they have been cooled sufficiently, partly by the air and partly by cold water, they are wound up and the silk gum is removed in various ways.

The chief factor in this operation is a completely neutral soap bath. This is of course very risky as the quality of the material is liable to suffer on account of the danger of the wool felting. This part of the process is therefore often shortened as much as possible, or the use of very concentrated liquors is avoided by making up for it in some other part of the treatment.

To do this the goods are previously treated in a hot bath which contains at first about $\frac{1}{4}$ of hydrochloric acid, $\frac{1}{2}$ of sodium phosphate being afterwards added, or the silk gum may be removed by means of steam.

In the latter case the pieces are passed for $\frac{1}{2}$ hour through a hot solution of 8 oz. neutral soap per gallon of water, after which the gum is completely removed in a special steaming apparatus.

After the silk gum has been removed, the goods are frequently steamed again on a perforated cylinder in a manner similar to the steaming of woollen piece-goods.
Apparatus for dyeing.

Gloria and bengaline are dyed in the same or similar apparatus to those which are used for crabbing and for removing the silk gum.

Fancy goods have generally been subjected to the above-mentioned processes before they come into the dye-house. They are generally dyed in the rope form in an ordinary piece dye-vat.
Methods of dyeing.

The choice of the conditions of working and of the dyestuffs used depends on whether the silk and wool have to be dyed different colours or whether both require to be dyed the same colour. In the latter case the silk must sometimes be dyed the same depth of shade as the wool, but frequently it must be left a little lighter than the wool and this must also be taken into consideration.

Two-Colour Effects (Shot).

Wool and silk dyed different colours.

One-bath process.

Several of these effects can be produced in one bath by using colours which only slightly dye the silk in combination with colours which dye the wool and silk the same depth of shade.

In such cases the material is always dyed at the boil in a bath which has been strongly acidified with sulphuric acid as described below. The shade of the dyeings can be regulated to a certain extent by increasing or diminishing the amount of acid used.

It is only in very few cases, however, that dyeings produced in this manner show as sharp a contrast in colour as those which are produced by the several-bath method.
Example of this method of working.


Dye at the boil in a bath which has been acidified with sulphuric acid with

\[
\begin{align*}
2 \text{ lbs. } &\text{ Wool Green } S \\
1 \text{ lb. } &\text{ Acid Magenta } S \\
1 &\text{ » Azoflavine RRR}
\end{align*}
\]

for 100 lbs. of glory.

The larger the quantity of sulphuric acid which is used in this case, the purer will be the green which is obtained on the silk, as in a boiling acid bath the Acid Magenta S, which has a dulling effect on the green, is chiefly absorbed by the wool.

Several-bath process.

As already mentioned the most beautiful and varied shot effects can only be produced by the several-bath process.

In such cases the wool is always dyed with those colours which, under the conditions which are described below, leave the silk as white as possible.

If, however, the silk of material which is required for black or dark shades, becomes dyed so much that the required shot effect could not be produced with it, the colour is stripped in a fresh boiling bath with acetate of ammonia. On the other hand, if light shades are required it is most frequently the case that the silk is only mechanically soiled and not really dyed. In such cases the goods are rinsed in water to which a little bran has been added. A small quantity of Turkey-red oil has also a similar effect.

The silk is then dyed in a lukewarm bath which has been acidified with acetic acid, with basic colours.
Description of the several-bath method.

Process 1.

Dyeing the wool.

The goods are entered at the boil and in addition to the necessary amount of colour solution one pint of acetic acid 9° Tw. is added for every 500 gallons of water. This quantity of acetic acid is added repeatedly at intervals of 10 minutes, and later on these additions are increased, until after boiling for 1½—2 hours the bath is almost completely exhausted.

The total quantity of acetic acid required is about 2 ½ gallons for every 500 gallons of moderately hard water.

When working in this way the colours mentioned in groups 1 and 2, page 280, leave the silk fairly light, and for many shades it is ready for dyeing after simply rinsing with lukewarm water.

For shades for which it is desirable to have the silk perfectly colourless or as near colourless as possible, it is stripped with acetate of ammonia or cleaned with water containing bran.

a) Stripping with acetate of ammonia.

This is done by working the goods for 10 minutes in a boiling bath which contains 3 gills of neutral acetate of ammonia in 100 gallons of water. As this treatment cannot be carried out without the wool losing more or less colour, it is advisable to stop as soon as the silk is clear enough.

If this is not the case after working for 10 minutes, it is advisable to pass the goods through a fresh stripping bath in which they will generally not require to remain longer than 5 minutes.

Finally rinse and dye the silk.

b) Rinsing with an addition of bran.

Add 1 lb. of bran for every 10 gallons of lukewarm water in the bath and work the pieces through this bath for 20 minutes. Now rinse, if possible in running water.
Materials consisting of silk and wool. Methods of dyeing.

c) Rinsing with an addition of Turkey-red oil.

Work the goods for \(\frac{1}{4}\) hour in a lukewarm bath which contains 1\(\frac{1}{2}\) — 3 gills of Turkey-red oil to every 10 gallons of water.

d) Treatment with hydrogen peroxide.

Work the dyed goods in a weak bleaching bath until the silk appears sufficiently pure. This method gives good results with Tartrazine, Acid Magenta S, Red Violet 5 RS, Indigo Carmine D.

Dyeing the silk.

Dye at 86\(^\circ\) F. in a bath which contains 3 — 6 gills of acetic acid 9\(^\circ\) Tw. per 100 gallons of moderately hard water. The bath does not exhaust and after suitable additions it can be used again.

Notes.

1. If when dyeing the wool with colours whose general properties render them suitable for use in the above method the silk absorbs too much of the colour, then either the dyeing has been effected at too low a temperature or too much acid has been added from the beginning.

2. If the wool loses too much colour when stripping the silk with acetate of ammonia, then either the liquor is too concentrated or the goods have been left in too long. It is far less dangerous to use two weak baths for 5 minutes each, one after the other, than to use one bath which is too strong for 10 — 15 minutes.

3. The quantity of silk in the material, the manner in which the silk gum has been removed, and the way in which the material has been woven, have a very great influence on the result which is obtained. Thus it frequently happens that the same colour dyed under the same conditions will dye the silk of one material considerably darker than that of another.

The dyer has, of course, no means of preventing this.
Materials consisting of silk and wool. Methods of dyeing.

One-Colour (or solid) Effects.

When dyeing the wool and silk the same color, other conditions, and to a certain extent other dyestuffs, must be chosen than those which are used for producing shot effects.

Process 2.

Description of the dyeing process.

For 20 lbs. of material consisting of silk and wool.

Enter the well-wetted goods into a cold bath which contains 60—80 gallons of water and add about \( \frac{3}{5} \) of the necessary amount of colour solution and 1 lb. sulphuric acid 168° Tw. Raise slowly in \( \frac{1}{2} \) hour to the boil and boil until the wool has almost acquired the desired depth of shade. As a rule this requires \( \frac{1}{4} \) hour or a little longer.

Turn off the steam and let the bath cool down to about 140° F. Add remaining \( \frac{2}{5} \) of colour solution which dyes the silk so rapidly that in most cases the dyeing is finished in 15—20 minutes.

It is sometimes desirable to shade off the silk with some basic colour. In such cases the first bath is run off and the silk is topped at the ordinary temperature in a fresh cold bath which has been acidified with acetic acid. The goods are then rinsed, &c.

Notes.

The conditions of dyeing vary somewhat for each quality of material consisting of silk and wool, but as a rule it is only the quantity of acid and the period of boiling which require to be altered.

The above process can therefore only serve as an example and does not claim to be reliable in every case.
The following method can be used for producing a black which is often required on gloria or similar materials consisting of wool and silk.

For 100 lbs. of material consisting of wool and silk.

The goods which have been slightly washed are entered at the boil into a bath containing

\[
\begin{align*}
3 & - 4 \text{ lbs. } Palatine \text{ Black 6 B} \\
4^{3/4} \text{ oz. } Fast \text{ Red AV} \\
10 & \text{ lbs. calcined Glauber's salt (or twice this amount of crystalline Glauber's salt).}
\end{align*}
\]

At intervals of \(1/4\) hour \(2^{1/2}\) lbs. of bisulphate are added four times, the bath is cooled down to \(120^\circ\) F. and the silk is dyed with

\[
\begin{align*}
3 & - 4 \text{ lbs. } Palatine \text{ Black 6 B} \\
9^{1/2} \text{ oz. } Fast \text{ Red AV} \\
4^{3/4} & - 8 \text{ } Azoflavine \text{ RS.}
\end{align*}
\]

Another method is as follows:—

The goods are dyed with Brilliant Black B which can be shaded off as required with Light Green SF blue shade, Tartrazine, or Azoflavine towards deep black. 10 lbs. of bisulphate are previously dissolved in the bath, the goods are entered cold and raised in \(1/2\) hour to the boil. After boiling for \(1/4\) hour add another 10 lbs. of bisulphate, boil for another \(1/2\) hour and then rinse thoroughly.

Now pass the goods for 1 hour through a cold solution of chromium chloride \(33^\circ\) Tw., rinse again, then top at the boil for \(1^{1/2}\) hours with logwood and fustic extract. Finally rinse, &c.

Choice of colours for dyeing the wool for shot effects.

1. When working according to process 1, page 277, the following colours stain the silk so little that the latter can be finished without any further treatment.

2. When working under the above-mentioned conditions the following colours stain the silk more or less, but it can easily be stripped with acetate of ammonia:—

*Naphthol Yellow* S, *Orange G*, *Cochineal Red A*. (Also the colours mentioned under 1 if they have stained the silk on account of careless working.)

3. The following colours certainly dye the silk, but for most purposes it can be stripped sufficiently with acetate of ammonia:—


Also the colours mentioned under 2.

Choice of colours for dyeing the silk for shot effects.

4. For this purpose most of the so-called basic colours are used, e. g.,—


Choice of dyestuffs for producing one-colour (solid) effects.

5. When dyeing the wool in materials consisting of wool and silk in a bath which has been strongly acidified the following colours also dye the silk a full shade:—

Preparation of unions for dyeing.

As a rule unions which contain white or light coloured wool do not require any special preparation before dyeing, with the exception, of course, of the usual crabbing, &c.

If the goods contain grease, or do not appear quite clean, they are run through a lukewarm rinsing bath which contains a little soda or ammonia (see page 88). Many qualities of unions, however, contain dark or black shoddy weft, and in order to produce bright shades on such materials it is necessary to strip this colour as well as possible.

The following are the most important methods used:—

a) Boiling for 1/2 hour in a solution of 6—15 gills acetate of ammonia B. A. S. F. per 100 gallons of water.

This method has without doubt the least destructive action on the goods and it always gives good results with shoddy dyed with ordinary Aniline colours.

b) Treating the goods for 1/2 hour at 95—104 °F. in a solution which contains 2—2 1/2 lbs. of calcined soda per 100 lbs. of material.

c) Boiling in a solution which contains 2—6 lbs. of bichromate of potash (or bichromate of soda) and an equal quantity of sulphuric acid 168 °Tw. per 100 lbs. of goods.

This method is one of the most generally used. If the goods have to be dyed by the several-bath method (see page 289) it is often carried out as follows:—The material is worked for 1/2 hour in the chrome bath which is then cooled down a little, after which the colour solution is added and the goods are dyed direct.

(In several cases the colour solution can be added at the beginning to the chrome bath. This is possible, for example, when using Naphthol Yellow S for olive shades.)
It should be noted that the dyeing must always be carried out as quickly as possible, for if the bath is boiled too long, a part of the colour which has been stripped off, is liable to be taken up again by the material and to dull the shade.

The following products are frequently used in the manner which has just been described:

for navy blue: — Soluble Blue 3376, SV, HA, HB,
for Russian green: — Light Green SF yellow shade and SF blue shade,
for claret: — Acid Magenta S and SS and Wool Scarlet RR,
for olive: — Naphthol Yellow S, Orange N.

If the goods have to be dyed by the so-called one-bath process, either they may be rinsed after stripping with chrome, neutralised with a little soda or ammonia and finally dyed in a fresh bath, or soda may be added to the chrome bath until every trace of acid is neutralised, after which the colour solution is added and the goods are dyed.

As a rule this latter shortened method of working is not to be recommended. It is chiefly used when sufficient vats are not available, or, when by chance, only a few union pieces have to be dyed so that the liquors could not in any case be further utilised.

d) In other cases the goods are, besides other treatment, first stripped in acid baths, e. g., with oxalic acid, hydrochloric acid, &c.; or reducing agents may be added, e. g., tin salts along with a little hydrochloric acid.

A very radical method of stripping, which is used for certain materials, is to boil for 1/4 hour in a bath which has been strongly acidified with sulphuric acid. As much as 30 lbs. of sulphuric acid 168° Tw. are sometimes used per 100 lbs. of goods.

e) If the shoddy was dyed with wood colours, good results are often obtained when dyeing according to the several-bath process by making the first dye-bath which is used for the wool strongly acid.

This has the effect of stripping the greater part of the wood colours and at the same time of dyeing the wool with Aniline colours.

In several cases the action of the sulphuric acid is aided by an addition of a little oxalic acid.

f) Another method, which is however not popular, but which in some particular cases is almost indispensable, is to act upon the material with a cold solution of hypochlorite of soda, or bleaching powder which stands at 1/3—1/2° Tw.
g) A new method, viz.—stripping with sodium hydrosulphite often gives good results. It has, however, the disadvantage that the product in question loses greatly in strength on standing.

If it cannot be obtained fresh from a neighbouring indigo dye-house, it can be produced by the method which is described in the appendix (page 480).

The goods are worked for \(\frac{1}{4}\) hour at the boil in a bath which has been acidified with acetic acid after which the solution of hydrosulphite is added.

For 100 lbs. of goods use

200 gallons of water
1 gallon of ordinary acetic acid 9° Tw.
3 — 5 gallons of hydrosulphite solution.
Dyeing Unions.

The following are the methods which are used at the present time for dyeing unions:

1. The so-called several-bath method which is the oldest. The wool is first dyed in an acid bath and the cotton is then mordanted and afterwards dyed.

2. The one-bath method which has been very extensively used since the introduction of substantive dyes. Most of the shades which are required can now be produced in a simple manner by this method.

3. The two-bath method. The cotton is first dyed with substantive dyes and the wool is then dyed in a fresh acid bath.

   This method is frequently reversed, the wool being first dyed in an acid bath after which the cotton is dyed with substantive colours.

In addition to the methods which have just been mentioned, there are others which are more or less closely connected with them which are used for special articles. For example, mordanting the pieces with a small quantity of tannic acid (1—2 lbs.) and then dyeing the cotton and wool in one bath with certain basic colours (e. g., Victoria Blue B and 4 R).

Another method is to dye in a concentrated bath with such acid colours as have a sufficient affinity for cotton to dye it a full enough shade. (Cotton Scarlet, Erythrine RR, &c.). The dyeings obtained in this manner are, however, by no means fast to water or washing.
The several-bath method.

(Old process).

Apart from other advantages which might be mentioned in favour of the several-bath process for special cases, it is still preferred to-day for certain materials to the one or two-bath method, as it imparts to them a hard feel and also increases their weight.

The goods are dyed in the piece-dyeing machine in the usual manner (see page 94) with acid colours. They are then mordanted in a jigger or a vat with tannic acid or some similar tannin substance (sumach, myrabolans, &c.), slightly rinsed, after which the cotton is blackened with iron salts, or if the cotton requires to be dyed the same shade as the wool the goods are passed through a bath of iron or antimony salts and then dyed with basic colours.

As the shade of the wool is generally dulled when dyeing the cotton, it must from the first be dyed brighter than the pattern (see page 292).

For light shades the tannic acid is frequently fixed with antimony salt and then slightly dulled by adding a little iron mordant to the antimony bath.

The whole process of dyeing the cotton is very similar to the method which is used for dyeing cotton piece-goods with basic colours, with the exception that the mordanting and dyeing take place cold (see page 204).

Notes.

1. The blackening with iron salts is frequently effected in the rinsing machine or in an ordinary piece dye-vat instead of in the jigger.

In order to work as well and as cheaply as possible, care must of course be taken to keep the baths as concentrated as practicable.

The conditions of working should be as similar as possible as when working in the jigger.
2. When working in the jigger about 3 lbs. of tannic acid or a corresponding amount of some other tannin material is required for 100 lbs. of goods. The pieces are run 15 times through a cold bath and then rinsed by passing once through cold, standing water. The tannin is now fixed by running 4—6 times through a cold bath which contains 1 1/4 lbs. of antimony salt after which they are rinsed until clean.

The object of rinsing previously to passing through the antimony or iron bath is to remove as completely as possible any tannin substance which adheres mechanically to the wool and thus further to prevent the formation of an antimony or iron lake on the wool fibre.

The first would cause the basic colours to rub off more on to the wool and the latter would cause the shade of the wool to be dulled still more.

On the other hand the goods must not be severely rinsed after passing through the tannin bath as this would remove too much of the tannic acid from the cotton.

3. If the cotton has to be darkened by means of iron, the tannic acid is generally replaced by the cheaper sumach extract (about 54° Tw.) and from 15—35 lbs. of this are required depending on the quality and the shade desired, &c.

4. The most suitable iron salt is the so-called nitrate of iron which is placed on the market at a concentration of about 54° Tw. About 1 quart of nitrate is required to every three quarts of sumach extract. In many cases, however, considerably more than this is taken.

The advantages of nitrate of iron over pyrolignite of iron are that it does not dull the shade of the wool so much, that it has no unpleasant smell and gives a more beautiful (more bluish) black on a sumach mordant.

In the latter respect it is far superior to ferrous sulphate (green vitriol) which is the cheapest iron mordant.

When producing fancy shades for which the weft and warp must be dyed the same colour and where an iron mordant is used for darkening the cotton, the latter should at first be dyed if anything a little darker than the wool. Any excess of iron on the fibre can be removed by rinsing the goods in a bath which contains a little hydrochloric acid. This method is generally quicker and more certain than working direct to the pattern.

5. If logwood extract is to be used in conjunction with iron, it may be added to the sumach or iron bath.
6. A considerable saving is effected by repeatedly working in old tannin liquors. As a rule only one half of the original quantity of mordant is added for each fresh lot of goods.

On the other hand it is very important that the liquors should not be used too long, especially if the weather is warm and the vats are allowed to stand a day or two without being used, as in such cases there is always the danger of the liquors fermenting. This can be recognised by the formation of bubbles or mould and by a peculiar smell.

7. If difficulty is met with when darkening the cotton it will probably be due to the quality of the mordants.

Sumach extract especially may be spoilt, or if it has been obtained from unscrupulous dealers it may be adulterated. In the case of iron mordants the concentration might be wrong. An excess of acid has also an injurious effect on the latter.

8. Exactly the same rules as are mentioned above apply when producing two-coloured effects on unions.

In order to obtain good results it is very important to rinse slightly after the tannin bath and also to dye the cotton cold with an addition of 2—4 lbs. of acetic acid $9^\circ$ Tw. per 100 lbs. of material.

Below is a list of colours which are used for dyeing the wool and which leave the cotton almost white, viz:


The following are not quite so suitable but still they are very extensively used:


On the other hand there is no choice as regards the colours which can be used for cotton dyeing, as they are all to some extent attracted by the wool.
Unions. The one-bath method of dyeing.

This fact must therefore always be taken into account. For example, when producing red and green effects on the same piece the wool must be dyed as bright a red as possible, because when the cotton is afterwards dyed the wool will absorb a trace of the green which dulls the shade of the red.

Many shot-effects can be considerably improved in brightness by subjecting them to a light soaping after dyeing. This method is, of course, only made use of when absolutely necessary.

When dyeing unions so that the cotton and wool acquire exactly the same shade, the same precautions must also be observed. For example, if when producing a drab shade the wool was not left a little lighter and brighter than the pattern, it would become too dark when the cotton was afterwards dyed.

The colour is frequently liable to rub off unions which have been dyed a dark shade. In many cases this defect can be removed to some extent by finally treating the material in a weak tannin bath or with a thin hot solution of glue.

The one-bath process.

Fundamental principles.

1. As already mentioned, the chief point to observe when working according to this process is, that the goods must be perfectly free from acid. If this is not the case, the substantive dyes which are intended for the cotton will be taken up to a great extent by the wool and the cotton will remain too light.

When working with goods which contain shoddy it is therefore always advisable to first rinse them in the washing machine with water to which a little soda has been added.

If this process is carried out in the dye-vat itself and the rinsing water has to be used afterwards for dyeing it is best to use ammonia in place of soda, as any excess of the former is expelled by boiling.
2. This of course holds good for material which has been stripped with chrome salts and acid.

It must also be noted that many shades are difficult to produce on such material by the one-bath process as the substantive dyes are very readily absorbed by chromed wool.

3. When dyeing dark shades on union goods another important point is to keep the baths as concentrated as possible. It is advisable not to use more than 2 gallons of water for every pound of material. If the vats are suitably constructed or if the material to be dyed contains wool which does not easily form creases if dyed in a neutral or slightly alkaline bath, it is advisable to use only 15 parts of water to 1 of material or even less than that.

Under normal conditions of working there is no danger of the goods dyeing unevenly, as in the absence of acid the colour is very slowly absorbed by the fibre.

On the other hand, if dilute liquors are used the baths will exhaust badly, and in consequence it will be difficult to dye the cotton a full shade.

From what has been said it is clear that great care must be taken with regard to the introduction of steam into the vat.

If local conditions do not permit of the use of a closed steam-coil, the pipes should be so arranged that most of the condensed water which is carried over with the steam is removed by a tap at the side before the steam enters the open pipe of the dyeing machine (see page 134).

4. As a rule the only assistant which is added to the dye-vat is Glauber’s salt (or also common salt) but in many cases it is advisable to add also a little soda or ammonia. As already mentioned this prevents the substantive dyes from being absorbed too rapidly by the wool.
Description of the one-bath method.

For 100 lbs. of unions 125—150 gallons of water are used (for thin materials at the most 250 gallons.) The necessary amount of colour solution is added, and as fixing agent for dark shades in fresh liquor 30—40 lbs. of calcined Glauber's salt.

The goods are entered at 140°F. and dyed for \(\frac{1}{2}\) hour at this temperature, the bath is then raised to the boil (on an average this requires \(\frac{1}{4}\) hour) and boiled for \(\frac{3}{4}\) hour.

The shade is now examined, if necessary more colour solution is added, and the boiling is continued for another \(\frac{1}{4} - \frac{1}{2}\) hour.

If the correct shade is obtained after once shading off the total time required for dyeing is about 2 hours. If, on the other hand, the shade corresponds with the pattern without shading off \(1\frac{1}{2}\) hours will be sufficient.

After the dyeing is complete the goods are slightly rinsed.

Notes.

1. If the wool is almost up to shade and the cotton is still a little too light, the steam is turned off, and the dyeing is completed as the bath cools down, if necessary a little more substantive dye and Glauber's salt (or common salt which acts more powerfully) are added. In this way it is generally easy to dye the cotton a little darker than the wool.

2. When working with materials the wool of which requires very little dyestuff on account of its ground colour and the main object is to cover the white cotton, it is advisable to enter lukewarm and to keep at this temperature or to finally heat up to 140°F.

   In such cases the bath is not raised to the boil at all. This method of dyeing depends upon the fact that cotton absorbs a sufficient quantity of colour at a low temperature, whereas wool requires a higher temperature for dyeing.

3. For the same reason it is advisable when dyeing piece-goods which contain large visible burls, to only add one half the requisite quantity of substantive dye at the beginning. The other half is added to the bath as it cools down. The Glauber's salt, &c is also added in the same manner.
4. In addition to the substantive dyes a series of other dyestuffs is also used for the one-bath method. These really belong to the group of acid dyes, but they also possess the property of being strongly attracted by the wool in a neutral bath.

As a rule these products are faster to light and wearing than the substantive dyes. They should therefore not only be used for shading the wool, but in the case of union goods the right side of which consists of pure wool, this wool should as a rule be dyed with these acid colours of which a list is given at the end of the chapter, and those substantive dyes should be chosen for covering the cotton which are not attracted so strongly by the wool.

In this manner not only are brighter and cheaper dyeings obtained but the shade will also be faster than is the case if the wool contains too much of the substantive dyes.

5. A considerable saving of the substantive dyes can be effected by dyeing in old liquors, on an average only $\frac{3}{4} - \frac{2}{3}$ of the original quantity will be needed for each fresh lot of goods, when dyeing dark shades.

In many cases one half will be found sufficient.

If the amount of calcined Glauber's salt stated above has been added to the first bath, only about $\frac{1}{5}$ of this quantity will be required for following lots, i.e., about 6—8 lbs. for each 100 lbs. of material.

The quantity of acid dyes to be added to old liquors depends to a very great extent upon the special nature of the products in question.

*Fast Red AV, Acid Violet 4 BN, Alkali Violet, Alkali Blue, Neutral Blue for Wool* are generally only added in small quantities when working by this method. As they exhaust well from a neutral bath there can be no great saving with the following lots.

The contrary holds good with *Azoflavine RS, Orange II, Orange N, Rhodamine, Palatine Red, Acid Violet 6 BN, Wool Green S, Palatine Black 4 B, 6 B, and 6 BE*, as these colours do not exhaust to the same extent.

Of course no fixed rules can be given as great alterations are caused by variations in the proportion of cotton to wool in the material and in depth of shade. The demands made with regard to the similarity in shade of the cotton and wool also vary to a great extent and influence the result.
It is naturally more expensive to dye those materials, the cotton of which must be darker than the wool, than it is to dye those materials in which the cotton simply requires to be covered and no special value is laid upon its shade.

6. If the feel of the goods suffers too much by the one-bath method of dyeing they are afterwards passed through a gum solution, or dextrine may be added to the dye-bath.

A considerable improvement can also be effected by rinsing in water which has been well acidified. In most cases, however, one has then to cope with a considerable alteration in shade.
The two-bath method.

All the general rules which have been previously stated for dyeing unions by the one-bath process and those which relate to the dyeing of wool in an acid bath also hold good for this new process.

The following are the chief conditions for obtaining good results:

If the cotton is dyed first,

those substantive dyes should be chosen

1. which under certain conditions of working dye the cotton a full shade without being attracted too much by the wool, and

2. which are so fast to acids that when the wool is afterwards dyed in an acid bath they are not stripped too much from the cotton, or if they are slightly stripped, they do not dye the wool another shade.

If it is intended to dye the cotton afterwards,

those substantive dyes should be chosen which under certain conditions of working dye the cotton a full shade without being absorbed too much by the wool.

Both forms of the two-bath process are of special interest for dyeing bright shades on raw pieces which contain a white cotton warp and a dark coloured shoddy weft, and the warp is to be dyed black and the weft a dyed bright colour, e.g., navy blue, brown, or claret.

This method is also valuable for unions which have to be dyed brighter blacks which are also faster to light than those which can be produced by the one-bath process.

For example, in such a case one would dye the cotton warp with Grounding Black for Cotton and then dye the wool in an acid bath with a suitable Palatine Black brand.
Unions. The two-bath method of dyeing.

This method of working is frequently more suitable than first dyeing with acid colours and then blackening the cotton with substantive dyes.

This is chiefly due to the fact that it is difficult to completely remove the acid which has been used for previously dyeing the wool. Any such acid remaining in the goods causes the substantive dyes, which are duller and frequently not so fast to light, to be attracted more strongly by the wool.

Description of the two-bath method of dyeing.

a) Dyeing the cotton before the wool.

For 100 lbs. of unions which are free from acid use about 150 gallons of water to which has been added

5—6 lbs. of *Grounding Black 4B for Cotton*
20 » » calcined Glauber's salt or common salt
2 » » calcined soda.

The goods are entered into the cold bath which is then slowly raised to 95—104° F., and the cotton is dyed for \(\frac{1}{2}-\frac{3}{4}\) hour at this temperature.

The above-described process is best carried out in the rinsing machine as then the amount of water used can also be considerably reduced and only one-half the quantity of Glauber's salt is required.

After rinsing slightly the wool is dyed in a fresh bath to which 20 lbs. of Glauber's salt and 3\(\frac{1}{2}\)—4 lbs. of sulphuric acid 168° Tw. (or about 12 lbs. of bisulphate) have been previously added.

Enter lukewarm, raise slowly to the boil and boil for \(\frac{3}{4}\) hour.

The following products are specially adapted for dyeing the wool:—

Notes.

a) If when dyeing the cotton too much of the black is taken up by the wool, then the goods are not free from acid or the temperature has been allowed to rise above 95—104°F.

b) If when the wool is being dyed the warp loses too much colour, the dye-bath has not been kept acid from the beginning.

c) If the colour rubs off, the slight rinsing after the cotton has been dyed has been omitted.

b) Dyeing the wool before the cotton.

The wool is dyed in an acid bath in exactly the same manner as when working with pure woollen goods (see page 94). If, however, dark coloured shoddy weft is present which requires to be partially stripped at the same time, a very strongly acid bath is used.

If this slight stripping is not sufficient one of the stripping processes described on page 285 and following pages must be used.

In all cases the goods are thoroughly rinsed after dyeing (if necessary a little ammonia or soda is added) after which the cotton is dyed in a cold concentrated bath with substantive dyes; it is then slightly rinsed.

Amongst others the following are suitable for dyeing the cotton after the wool has been dyed:—

- Cotton Yellow R.
- Pyramine Orange R.
- Thiazone Brown G, R.
- Oxamine Red.
- Oxamine Claret M.
- Oxamine Garnet M.
- Oxamine Violet.
- Oxamine Blue RRR, A, RX, B.


Note.

If the above-mentioned black is used for covering the cotton or if soda must be added to the dye-bath, only colours which are sufficiently fast to alkalies must be used when first dyeing the wool. For example, one would replace Light Green by Wool Green S, &c.

Of course, another means is to use as small a quantity of soda as possible.

An addition of a little acetic acid to the last rinsing bath has also a brightening effect on shades which have suffered in this manner.
Mercerising and dyeing unions in the piece.

The mercerising of unions in the piece which has recently been extensively carried out may have several objects. In most cases it is performed in order to produce the so-called figured goods.

The unions which are intended for this purpose are specially constructed, so that the shrinkage of the cotton produced by mercerisation causes the wool to stand out and form a raised pattern.

In the case of other articles the object is to increase the lustre and the affinity of the material for dyestuffs. As in such cases a noticeable shrinkage must be avoided, the goods must be mercerised under tension like cotton piece-goods.

When mercerising unions, special precautions must be taken on account of the sensitiveness of wool towards alkalis. These chiefly consist in using a caustic soda solution of 52° Tw. and not allowing the temperature to rise above 50° F.

The mercerisation is effected in a padding machine which is fitted with a cooling arrangement. The goods which have been previously prepared and hydro-extracted remain for a very short time in this liquid. (From 1—3 minutes, depending upon the strength of the caustic, the nature of the material, &c.)

They are then immediately passed into a bath which is kept strongly acid, after which they are thoroughly rinsed.

Those colours which are mentioned on page 303 are suitable for dyeing the cotton and to these Pyramine Orange 3 G, R R, Phenamine Blue B, G, R might also be added.

If suitable dyestuffs are chosen the mercerisation can also take place after dyeing, but this is a method which would only be made use of in special cases.

Our various substantive dyes, also Kryogene Brown, Kryogene Black B, G and Anthraquinone Black, so far as their shade is concerned, will withstand the mercerising process. They leave the white wool in so far unaffected that it can afterwards be dyed a different colour.
If the wool which is present in the goods must suffer so little in purity that it can still be considered as white the following colours are recommended for trial:

- Sulphine A, N. Cotton Yellow GI, GR. Pyramine Orange RR.

The dyeing of uncarbonised rags, waste, union yarns, &c.,

in one bath.

In this case the same principles hold good as when working with union piece-goods.

In several cases when dyeing waste, &c., it is advisable to add a little acetic acid towards the end of the dyeing process in order to produce a sufficiently full shade on the wool.

When dyeing rags which have not been torn up in the “devil” special care must be taken that any sewing threads present are sufficiently penetrated, so that they will not become visible when the rags are afterwards torn up.

As a rule, rags and waste which have been dyed with substantive dyes are fast enough to withstand a light milling, and under normal conditions the colour will not bleed into white wool.

If, on the other hand, the goods must be dyed so that the colour will not bleed into white cotton when they are milled, only those colours can be used which are rendered sufficiently fast by treating the dyed goods with copper sulphate (or bichromate of potash and copper sulphate).

The following products are recommended for trial:

- Cotton Yellow GI (or also Cotton Yellow R). Oxamine Red. Oxamine Blue B. Phenamine Blue G (or also B and R). Cotton Black 3B developed with Nitrosamine solution.
Two-colour effects on unions

can be produced in the following ways:

1. By using such acid dyes as are strongly attracted by the wool in a neutral bath (see list a on the following page) in conjunction with such substantive dyes as are chiefly absorbed by the cotton when dyed in a bath at a medium temperature, e.g.,

- Cotton Yellow G1
- Pyramine Orange R.
- Oxamine Red.
- Oxamine Claret M.
- Oxamine Garnet M.
- Oxamine Maroon.
- Oxamine Blue B, RX, RRR.
- Cotton Black BN and G.

By working in this manner at 140—158 °F and making the other conditions of working the same as those described in the one-bath method of dyeing, beautiful two-colour effects will be obtained.

2. The above-mentioned substantive dyes and also the Phenamine Blues can be used for dyeing the cotton in unions the wool of which should remain white. Only one bath is used for dyeing which takes place in the alkaline liquors during milling.

It is best to add a little caustic soda to the soap used. Not more than 1 lb. of the former should be used for 100 gallons of water and it should be poured on to the dyestuff when dissolving it.

3. Another method which can be used for producing two-colour effects is to first dye the wool in the usual manner with acid dyes, rinse well and then dye the cotton with substantive dyes.

The cotton is dyed in a cold concentrated bath which contains \( \frac{1}{2} - 1 \) lb. of caustic soda 76 °Tw. per 100 gallons of water. The colour is dissolved in conjunction with the caustic soda as mentioned above.

If the shade of the wool suffers too much when dyeing the cotton in this alkaline bath, it can in most cases be brightened up again by rinsing in an acid bath.

The colours mentioned above under 1 and 2 are suitable for this method of working.

4. The two-bath method a described on page 298 is specially adapted for producing a black warp and a coloured weft.
Choice of colours for dyeing unions according to the one or two-bath methods.

The following Aniline dyes are specially suited and are extensively used:

a) For dyeing the wool only:


The above-mentioned dyestuffs dye the wool a full shade in a neutral bath (without any acid whatever) and leave the cotton perfectly, or almost, white.

b) The following are used chiefly for dyeing the cotton:


The above products dye the cotton a full shade in a lukewarm bath and leave the wool a fairly light shade. If dyed in a hot bath they also cover the wool to a greater or less extent.

c) The following serve for dyeing both wool and cotton:

Union Black B, BB, 4B.

Also those mentioned under b when dyed in a hot or boiling bath.

Note.

The above products which are marked * dye very evenly; in consequence they can be used for producing light fancy shades by the one or two-bath methods.

For medium and dark shades all the colours mentioned under a, b, c can be used.
Pattern-Sheets.

Unions

Materials consisting
of Silk and Wool (Gloria, etc.)

Materials consisting
of Silk and Cotton.
### Unions.

Dyed in one bath with colours which are attracted chiefly by the cotton.

<table>
<thead>
<tr>
<th>Cotton Yellow G.I.</th>
<th>Cotton Red 4 B.</th>
<th>Oxamine Blue B.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton Yellow R.</td>
<td>Thiazine Red R.</td>
<td>Oxamine Blue RX.</td>
</tr>
<tr>
<td>Cotton Orange R.</td>
<td>Oxamine Red.</td>
<td>Oxamine Blue R.R.</td>
</tr>
<tr>
<td>Pyramine Orange R.</td>
<td>Oxamine Claret M.</td>
<td>Grounding Black for Cotton.</td>
</tr>
<tr>
<td>Thiazine Brown G.</td>
<td>Oxamine Maroon.</td>
<td>Grounding Black for Cotton 4 B.</td>
</tr>
<tr>
<td>Thiazine Brown R.</td>
<td>Oxamine Violet.</td>
<td>Cotton Black B.N.</td>
</tr>
</tbody>
</table>

### Unions.

Acid dyes which dye the wool only, in the one-bath process.

<table>
<thead>
<tr>
<th>Azoflavine S.</th>
<th>Rhodamine B.</th>
<th>Wool Green S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange N.</td>
<td>New Claret L.</td>
<td>Neutral Blue for Wool.</td>
</tr>
<tr>
<td>Orange H.</td>
<td>Alkali Violet 4 B.</td>
<td>Palatine Black 6 B.E.</td>
</tr>
<tr>
<td>Fast Scarlet B.</td>
<td>Alkali Violet 6 B.</td>
<td>Union Black 4 B.</td>
</tr>
<tr>
<td>Fast Red A brands.</td>
<td>Alkali Blue B extra.</td>
<td>Union Black B.</td>
</tr>
</tbody>
</table>
Materials consisting of Silk and Wool.

Dyestuffs which only slightly dye the silk.

*(Process 1, page 277.)*

<table>
<thead>
<tr>
<th>Material</th>
<th>Color Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tartrazine</td>
<td>Acid Magenta S.</td>
</tr>
<tr>
<td>Fast Yellow</td>
<td>Red Violet 5 R.S.</td>
</tr>
<tr>
<td></td>
<td>Indigo Carmine D.</td>
</tr>
<tr>
<td></td>
<td>Brilliant Black B.</td>
</tr>
</tbody>
</table>

Materials consisting of Silk and Wool.

Dyestuffs which can afterwards be sufficiently stripped from the silk.

*(Process 1a, b, c, page 277.)*

<table>
<thead>
<tr>
<th>Material</th>
<th>Color Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinoline Yellow</td>
<td>Scarlet R.R.</td>
</tr>
<tr>
<td>Orange G.</td>
<td>Azocarmine B.</td>
</tr>
<tr>
<td></td>
<td>Light Green SF yellow shade.</td>
</tr>
<tr>
<td></td>
<td>Brilliant Black B.</td>
</tr>
</tbody>
</table>

Materials consisting of Silk and Wool.

Colours which dye the wool and silk evenly.

*(Process 2, page 279.)*

<table>
<thead>
<tr>
<th>Material</th>
<th>Color Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinoline Yellow</td>
<td>Azocarmine G.</td>
</tr>
<tr>
<td>Azoflavine FF</td>
<td>Acid Violet 4 R.</td>
</tr>
<tr>
<td>Orange H.</td>
<td>Acid Violet 3 B.N.</td>
</tr>
<tr>
<td>Silk Red G.</td>
<td>Acid Violet 6 B.N.</td>
</tr>
<tr>
<td>Fast Scarlet B.</td>
<td>Alkali Blue B extra.</td>
</tr>
<tr>
<td>Fast Red AV</td>
<td>Soluble Blue 1 N.</td>
</tr>
<tr>
<td></td>
<td>Induline N N.</td>
</tr>
<tr>
<td></td>
<td>Fast Blue 5 B.</td>
</tr>
<tr>
<td></td>
<td>Wool Green S.</td>
</tr>
<tr>
<td></td>
<td>Light Green SF yellow shade.</td>
</tr>
<tr>
<td></td>
<td>Palatine Black 6 B.</td>
</tr>
<tr>
<td></td>
<td>Fast Red AV.</td>
</tr>
<tr>
<td></td>
<td>Azoflavine RS.</td>
</tr>
<tr>
<td></td>
<td>Rhodamine B.</td>
</tr>
</tbody>
</table>
### Materials consisting of Silk and Cotton.

**Substantive dyes which only slightly dye the silk in an alkaline soap bath.**

*(Process B, page 268.)*

<table>
<thead>
<tr>
<th>Materials consisting of Silk and Cotton.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton Yellow G.L.</td>
<td>Thiazine Brown G.</td>
<td>Cotton Corinth G.</td>
</tr>
<tr>
<td>Cotton Yellow G.R.</td>
<td>Thiazine Brown R.</td>
<td>Oxamine Garnet M.</td>
</tr>
<tr>
<td>Cotton Yellow R.</td>
<td>Cotton Brown R.</td>
<td>Oxamine Violet.</td>
</tr>
<tr>
<td>Cotton Yellow GRR.</td>
<td>Cotton Red 4 B.</td>
<td>Oxamine Blue RRR.</td>
</tr>
<tr>
<td>Pyramine Orange 3G.</td>
<td>Thiazine Red G.</td>
<td>Oxamine Blue R.X.</td>
</tr>
<tr>
<td>Pyramine Orange R.</td>
<td>Thiazine Red R.</td>
<td>Oxamine Blue B.</td>
</tr>
<tr>
<td>Pyramine Orange R.R.</td>
<td>Oxamine Red.</td>
<td>Cotton Black BN.</td>
</tr>
</tbody>
</table>

### Materials consisting of Silk and Cotton.

**Dyed with substantive and topped with basic dyes.**

*(Process B, page 268.)*

<table>
<thead>
<tr>
<th>Materials consisting of Silk and Cotton.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground: Cotton Yellow G.R.</td>
<td>Oxaamine Blue B</td>
<td>Cotton Red 4 B</td>
</tr>
<tr>
<td>topped with:</td>
<td>topped with:</td>
<td>Oxamine Red</td>
</tr>
<tr>
<td>Auramine II</td>
<td>Methylene Blue B H</td>
<td>topped with:</td>
</tr>
<tr>
<td>Chrysoidine A.</td>
<td>Methylene Blue RX</td>
<td>Rhodazine B.</td>
</tr>
<tr>
<td>Ground: Oxaamine Blue B</td>
<td>Thiazine Red R.</td>
<td>Oxaamine Red</td>
</tr>
<tr>
<td>Cotton Yellow R</td>
<td>topped with:</td>
<td>Oxamine Violet</td>
</tr>
<tr>
<td>topped with:</td>
<td>Rhodamine S</td>
<td>Diamond Magenta</td>
</tr>
<tr>
<td>Rhoamine A</td>
<td>Rhodamine B.</td>
<td>1 small needles</td>
</tr>
<tr>
<td>Methylene Blue RX</td>
<td></td>
<td>Auramine I.</td>
</tr>
<tr>
<td>Auramine I.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground: Cotton Yellow R</td>
<td>Pyramine Orange 3 G</td>
<td>Oxaamine Red</td>
</tr>
<tr>
<td>Phenamine Blue B</td>
<td>Thiazine Red R</td>
<td>Cotton Black BN</td>
</tr>
<tr>
<td>topped with:</td>
<td>Phenamine Blue R</td>
<td>Alkali Blue B</td>
</tr>
<tr>
<td>Rhoamine A</td>
<td>topped with:</td>
<td>extra</td>
</tr>
<tr>
<td>Methylene Blue RX</td>
<td>Quinoline Yellow</td>
<td>topped with:</td>
</tr>
<tr>
<td>Orange II</td>
<td>topped with:</td>
<td>Nile Blue R.</td>
</tr>
<tr>
<td>Ground: Oxaamine Red</td>
<td>Pyramine Orange 3 G</td>
<td></td>
</tr>
</tbody>
</table>
Jute.
Preparation of Jute for Dyeing.

Wherever practical, jute is dyed in the unbleached condition. Bleached yarn is only used where is absolutely necessary on account of the clearness of the shade required.

In principle the bleaching process is the same as that for cotton, but as the jute fibre is much more sensitive only 1—2 lbs. of bleaching powder are used per 100 lbs. of jute yarn.

After being soured the goods must be thoroughly rinsed, as if traces of acid are allowed to remain in the fibre it sometimes becomes quite brittle.

The chlorine bleach can be replaced by one with permanganate and sulphurous acid. (See under permanganate of potash, page 452.)

Choice of Dyestuffs.

The colours used for jute dyeing depend on the fastness required, &c. As a rule they do not require to be specially fast, the most important consideration being cheapness.

The basic dyes are most frequently used for jute, but the acid dyes have in most cases the advantage over these of being faster to light, and of penetrating better. The shades obtained with the acid dyes are not fast to water, but on the other hand, they are fast to grease and oil, i.e., acid colours will not dissolve in the latter and they do not, therefore, give rise to coloured spots on objects with which the jute may come into contact.
The following acid colours are suitable for dyeing jute:

- Naphthol Yellow S.
- Azoflavine RS, RRR.
- Orange N, II, X, R.
- Fast Brown N.
- Silk Red G.
- Scarlet RA.
- Scarlet R—RRR.
- Cotton Scarlet.
- Erythrine P.
- Fast Scarlet B.
- Fast Red AV.
- Soluble Blue PP, 3376, TR.
- Pure Blue I, WA.
- Soluble Blue IN.
- Fast Blue R, 5B.
- Wool Green S.
- Light Green SF yellow shade.
- Nigrosine W.
- Brilliant Black B.
- Palatine Black 4B.

The basic dyes are very extensively used for jute dyeing as cheaper dyeings can be produced with them on account of their strength.

On the average, however, they are not so fast to light and they do not penetrate so well, especially in light shades, as the acid dyes. They are as a rule not so fast to grease and oil.

The following basic colours are well suited for jute dyeing:

- Auramine II, G.
- Chrysoidine A, R, RL.
- Vesuvine extra, OO, BL, BB.
- Rhodamine B, 6G.
- Saffranine T extra, MN.
- Diamond Magenta.
- Magenta Powder A.
- Cerise DIV.
- Saffrannine Scarlet B.
- Magenta Scarlet.
- Methyl Violet.
- Crystal Violet.
- Ethyl Purple 6B.
- Methylene Blue BZ.
- Marine Blue BN, RN.
- Victoria Blue B, 4R.
- Dark Blue R.
- Cotton Blue B, R.
- Indoine Blue BB.
- Diamond Green G.
- Jet Black.
- Jute Black.

**Substantive Dyes.** The shades produced with these products are distinguished by being fast to water. They are fast to oils and fat and as a rule also to rubbing.

The following substantive dyes are very suitable for dyeing jute:

- Cotton Yellow GI.
- Cotton Orange G.
- Salmon Red.
- Pyramine Orange 3G, R.
- Cotton Red 4B.
- Thiazine Red G.
- Oxazine Red.
- Oxazine Claret M.
- Oxazine Garnet M.
- Oxazine Maroon.
- Oxazine Violet.
- Oxazine Blue BG, RRR.
- Phenamine Blue G, B.
- Cotton Black BN.

**Eosine Dyes.** These are only used when very bright red or pink shades are required.

In most cases they can be replaced by our Rhodamine B, shaded, if necessary, with Auramine II, as it gives faster dyeings and is easier to work with.

The following Eosine colours are specially valued for jute dyeing:

- Eosine MLG, BN.
- Erythrosine IN.
- Phloxine BBN, &c.
Method of Dyeing.

For 100 lbs. of jute yarn.

I. With Acid Dyes.

From 1—3 lbs. of alum (according to the depth of the shade required) are added to the dye-bath and the yarn is entered at the boil. It is turned 5—6 times at this temperature after which the steam is turned off and the dyeing continued for 1/2 hour as the bath cools down.

Notes.

a) The proportion of liquor to yarn should be about 10 : 1.

b) When dyeing dark shades the bath does not exhaust and it can be used again after the necessary additions have been made.

c) Alum has both a fixing and a developing action and it is not nearly so dangerous to the fibre as any of the acids.

d) When producing very bright shades in copper boilers it should be borne in mind that the metal has an injurious action on the clearness of the shade.

This can be partially counteracted by adding 3 oz. of ammonium sulphocyanide to every 100 gallons of dye-liquor.
II. With Basic Dyes.

Production of dark shades.

The unmordanted yarn is entered into the warm dye-bath at about 140—160° F. and turned 5—6 times. The steam is now shut off and the dyeing continued for 1/2 hour whilst the bath cools down.

Notes.

a) When dyeing dark shades it is frequently found difficult to get them even. The yarn is therefore entered into a cold bath, the colour is added at intervals in several portions, and the bath is then raised to the above temperature.

b) If in spite of the above precautions the goods turn out uneven or badly penetrated, an improvement can often be brought about by adding a small quantity of alum (1/4 lb. per 100 lbs. of yarn).

c) The proportion of yarn to liquid should be about 1:15 for dark shades and 1:20 for light shades. Under these conditions the whole of the colour is absorbed.

d) The dyeings can be rendered faster to rubbing and water by giving them a few turns in water to which 1 lb. of tannic acid or a corresponding amount of a decoction of sumach has been added. One must of course allow for the change of shade produced by this treatment.

e) When dyeing jute with Indoine Blue 1—3 lbs. of alum are added to the bath for every 100 lbs. of yarn.

The bath is finally raised to the boil and boiled for 1/4 hour.

III. With Substantive Dyes.

As fixing agent 10—20 lbs. of calc. Glauber’s salt (or common salt) are added to the bath in which the goods are dyed for 3/4—1 hour at the boil.
Jute. Methods of dyeing.

IV. With Dyes of the Eosine Group.

a) The bluest, i.e., the most valuable shades are obtained by preparing the first bath for dark shades with

- 3 lbs. of colour
- 100 gallons of water
- 40 lbs. of common salt

for 100 lbs. of jute yarn.

For light shades the bath should be prepared with

- 1—2 lbs. of colour
- 100 gallons of water
- 25 lbs. of common salt.

If these liquors are tested at 104.0°F, the first will show 2.1° Tw. and the second 1.4° Tw.

The goods are entered into the cold or lukewarm bath which is then raised to the boil, after which the steam is turned off and the dyeing is continued for 1/2 hour whilst the bath cools down.

When working with old liquors, in addition to the necessary amount of dyestuff common salt is added until the liquors show 2.1° Tw. or 1.4° Tw. respectively. For this purpose about 10 lbs. of salt are required for every 100 lbs. of yarn.

b) A second method which is, however, only used for producing yellower shades and more especially when working with the yellower Eosine brands (such as Eosine A, M.L.G., &c.) is to add 2 lbs. of alum and 2 lbs. of acetic acid in place of common salt. Enter the jute into the hot bath and dye for 1/2 — 3/4 hour whilst cooling down.
Linen.
According to the shade desired the linen fibre may be dyed in the raw state or in the quarter, half, three quarters, or completely bleached condition.

To give a description of the rather complicated bleaching process which is a combination of the grass and chlorine bleaching processes would require too much space.

The other preparation required before dyeing or mordanting consists in thoroughly boiling out in water to which a little soda has been added. The object of this treatment is to remove the size which is generally present in the yarn so as to facilitate the penetration of the fibre by the colour.

Mordanting Linen.

If linen is to be dyed with basic colours it must first be mordanted with tannin and antimony or tannin and iron. The method is exactly the same as that which is used for cotton, with the exception that the tannin solution must be used sufficiently hot in order to produce better penetration.

If delicate clear shades are required it is advisable to sour before mordanting with a little hydrochloric acid. In this manner any iron present in the fibre which would give a dull ground with the tannic acid is removed as completely as possible.
Choice of Colours.

The demands made with regard to the fastness of colours on linen vary according to the purpose for which the latter is intended.

If it is required for better apron and clothing materials it is generally grounded with fast colours (for blue, for example, Indigo or Indoine Blue is used) after which it is frequently topped with substantive dyes and finally brightened in the finishing process with acid or basic dyes.

If it has to be woven into patterns it must be fast to washing and light and also against bleeding into white when washed.

For cheaper goods the substantive dyes are often used and, if necessary, they can be developed on the fibre, or even basic colours may be used alone.

The various methods of dyeing are exactly the same as those which are used for cotton. The fibres are, however, harder and therefore more difficult to penetrate; for this reason one will, as a rule, require to work more slowly and carefully, both with regard to addition of colour solution and raising of temperature. In many cases the bath is finally raised to the boil.

In general the colours used for linen are the same as those which are used for cotton.
All that has been said with regard to the behaviour and dyeing of linen also holds good for hemp. The only exception is that cheapness generally plays a greater part with this fibre than with linen.

As a rule no special demands are made with regard to fastness unless it has to be worked up into twine which contains white and coloured yarn. In this case the colour must be fast against bleeding into white.

Amongst others the following are sufficiently fast in this respect:

**Acid dyes:**

*Pure Blue WA, I. (Orange X, Erythrine P, and Cotton Scarlet can also be used.)*

**Basic dyes:**

*Auramine II. Rhodamine 6 G. Saffranine T extra. Methylene Blue MD, BH. Diamond Green G. (Diamond Magenta, Magenta Powder A, Methyl Violet, Marine Blue BN, Victoria Blue B, and Jet Black can also be used.)*

**Substantive dyes:**

*Cotton Yellow GI. Pyramine Orange R. Oxamine Blue B. (Cotton Red 4 B, Oxamine Red, Oxamine Garnet M, Oxamine Dark Blue M, Cotton Brown RV, Cotton Black B can also be used.)*

**Eosine dyes:**

*Eosine A. Erythrosine IN.*
China-Grass.

China-grass also has exactly the same dyeing properties as linen and the demands made with regard to fastness are generally the same as those for a fine linen yarn.
Coir.

Cocoa-nut fibre is dyed both in the raw and the bleached condition. Its behaviour towards dyestuffs is similar to that of jute, but it has not quite so much affinity for Aniline dyes as the latter.

It is dyed in the same manner as jute, but when working with acid dyes sulphuric acid is frequently used in place of alum.
Printing Aniline Dyes

on

Cotton, Wool, Silk, &c.
A detailed consideration of the very extensive subject of printing would require too much space to be included in a treatise of this kind. It is therefore only discussed to such an extent as to give the reader a general insight into the subject.
General remarks on printing with Aniline Dyes.

The various methods of printing depend upon the use of a colour solution to which a thickening agent has been added. In most cases fixing agents (acids, &c.) or substances with which the dyestuffs can form lakes (tannic acid, chrome compounds) are also added and the material is printed with this mixture.

The printing-on may be done with

Roller or cylinder printing machines (for one or several colours),
Perrotine machines (only for indigo),
Printing blocks by hand.

The Foulard machine (padding or slop-padding machines) might also be mentioned here.

All other forms of apparatus, e.g., the duplex printing machines (for printing both sides of the material), the Vigoureux printing machines (for slubbing), yarn printing machines, drum or frame printing machines (for carpet yarn) are constructed upon the same principles as one or other of the above-mentioned machines.

After printing the goods are dried, or they are dried and then slightly moistened again. They are then steamed with or without pressure. In the case of many dyestuffs the correct development of shade and proper fixation takes place during this process.

This is followed by an after-treatment with fixing agents, the details of which depend upon the goods in question and the requirements. The goods are then rinsed, &c.

In order to obtain good results it is very necessary to choose a suitable thickening agent. Below we give several which may be considered as typical of their group.
A. Acetic acid-tragacanth-starch thickening with glycerine.

28 oz. of wheat starch
66 » » water
40 » » gum tragacanth solution 5°/0. (For the preparation of this, see page 332.)
6 » » glycerine
60 » » acetic acid 9° Tw.

are mixed together and boiled for 10 minutes.

Weight of the cold thickening = 180 oz.

This can be used for printing with all basic colours on cotton. As it is a smooth, soft thickening it is suitable for producing ground colours.

B. Acetic acid-tragacanth-starch thickening with oil.

25 oz. of wheat starch
52 » » water
60 » » tragacanth solution 5°/0
60 » » acetic acid 9° Tw.
3 » » olive oil.

Boil for 10 minutes.

Weight of the cold thickening = 160 oz.

This soft, smooth thickening is also used for printing basic colours on cotton.

C. Acetic acid-starch thickening.

2 lbs. of wheat starch
5 » » water
3 » » acetic acid 9° Tw.

are mixed together and boiled for about 15 minutes.

Weight of cold thickening = 8½ lbs.

This is used for printing patterns with basic colours on cotton. It is not so suitable for printing a ground colour.
D. Acetic acid-starch-dextrine thickening.

24 oz. of wheat starch
20 » » dextrine
52 » » water
40 » » tragacanth solution 5% /o
60 » » acetic acid 9° Tw.
4 » » glycerine.

Boil for 10 minutes.

Weight of cold thickening = 176 oz.

A soft, smooth thickening suitable for printing Methylene Blue on cotton.

E. Starch-dextrine thickening.

20 oz. of wheat starch is mixed with
20 » » water and to this is added
10 » » dextrine
40 » » tragacanth solution 5% /o
3 » » olive oil
107 » » water.

Boil for 10 minutes.

Weight of cold thickening = 178 oz.

A special thickening for printing Eosine and Azo-dyes on cotton.

F. Gum thickening.

5 lbs. of gum arabic and
5 » » cold water

are allowed to stand and steep for about 24 hours. Now warm for some time in order to bring about solution and make up with water to 10 lbs.

This is used for printing with colours, with discharges, viz:—zinc dust, tin salts, or acetate of tin, and also for chromate and chlorate discharges on cotton, wool, silk, and materials consisting of cotton and silk, &c.
G. Acetic acid-gum thickening.

5 lbs. of gum arabic are steeped in
2½ » » cold water and
2½ » » acetic acid.

After standing for about 24 hours the mixture is warmed in order to bring about solution and then made up with dilute acetic acid to 10 lbs. (1 part acetic acid 9° Tw. and 1 part water.)

This is used as a thickening for printing basic colours on cotton and silk and is suitable for producing ground colours and very delicate light shades.

H. 5°/o Tragacanth solution.

½ lb. gum of tragacanth is mixed with
1 gallon of water

and stirred at intervals for some time. The mixture is next boiled for 4—6 hours and the water which is boiled off is replaced so as to bring the mixture to about its original volume.

The total weight of the thickening when finished should be about 10 lbs.

This is used with an addition of acetic acid for producing light shades with basic colours. (For this purpose thickening G is generally preferred.)

It also serves for chromate and chlorate discharges on cotton (thickening F is still better adapted for this purpose).

Further for printing with Nitrosamine Red and for printing woollen yarn.

J. Starch-tragacanth thickening.

24 oz. of wheat starch
136 » » water
40 » » tragacanth solution 5°/o.

Boil for 10 minutes.

Weight when cold = 176 oz.

This is especially used for printing wool (yarn and piece-goods) when British gum, which is extensively used, is for some reason not desired.
Printing with Aniline Dyes. Typical Thickenings.

K. Starch thickening.

12 oz. of wheaten starch are mixed with 188 » » water and boiled for about 5 minutes.

This is used for printing acid dyes on woollen yarn, especially when printing carpet yarns with the drum.

L. Dextrine thickening.

6 lbs. of dextrine 4 » » water are mixed together and boiled for about 5 minutes.

This is used as a thickening for a tartar emetic resist for basic colours on cotton.

M. Acetic acid-British gum thickening.

4\(\frac{1}{2}\) lbs. of British gum 3\(\frac{1}{2}\) » » hot water 2 » » acetic acid 9° Tw.

are mixed together and boiled for 5 minutes.

This is a soft and smooth thickening which is chiefly used for wool but also serves for cotton, silk, and materials consisting of cotton and silk. It is used for white discharges with acetate of tin.

Note. Instead of preparing a thickening with British gum it is often preferred to add the latter direct to the colour solution.

From 22 to 35 oz. of British gum are added for every 100 oz. of liquid.

N. Flour thickening.

24 oz. of flour 176 » » water

are mixed together and boiled for 20 minutes.

Weight of the cold thickening = 180 oz.

This is used in some few cases for wool printing, especially for carpet yarn.
Printing with Aniline Dyes. Typical Thickenings.

O. Egg albumen thickening.

2 lbs. 8 oz. of egg albumen
2 » 6 » » cold water
2 » » ammonia liquor

are mixed together and allowed to stand for 12 hours, after which the mixture is sieved or passed through calico.

Serves as a thickening for the substantive and pigment colours. As a rule it is only used for clear light shades.

P. Blood albumen thickening.

2 lbs. 4 oz. of blood albumen
2 » 10 » » cold water
2 » » ammonia liquor

are mixed together, let stand for 12 hours and then sieved.

A thickening for substantive and pigment colours which is especially used for dark shades instead of the more expensive egg albumen.

Q. Caseine thickening.

15 oz. of powdered caseine
84 » » cold water
1 » » ammonia liquor.

This thickening is used instead of albumen for cheap articles.

R. Thickening for Acetine Blue.

1 lb. of wheat starch
3 lbs. » water
3 » » tragacanth solution 5 \%\%
3 » » acetic acid 9 \%\ Tw.

Boil for 10 minutes.

Weight of thickening when cold = 9 lbs.

It is used when printing cotton with Acetine Blue.
General remarks on thickenings.

The choice of thickenings depends upon:

I. the nature of the material to be printed,
II. the nature of the pattern to be printed,
III. the solubility of the colour used,
IV. the engraving of the rollers,
V. whether the printing is effected by machine or by hand.

Notes on I and II.

For instance, for heavy twilled cloths, thin, soft, and smooth thickenings are used; these easily give even prints. As a rule, when printing on thin cloths, and also if figures and not large blotches have to be printed, somewhat thicker thickenings must be used.

If blotches or light delicate shades are required, those thickenings are used which contain large quantities of tragacanth or which consist of gum alone.

Notes on III.

For colours which are difficultly soluble and which therefore require a large quantity of water to bring them into solution, the stiffer thickenings must be used.

On the other hand, the thickenings used for those colours which in themselves exercise to some extent a thickening action can be thinner.
Notes on IV.

When working with rollers with very shallow engravings thick printing pastes are generally used. If, however, the engravings are deep, a thinner, smoother, and softer thickening is frequently required.

In order to obtain even prints the following points should be borne in mind:

1. The thickenings must be thoroughly and evenly boiled or brought to a paste. They must not run on the goods.

2. The thickenings must be stirred cold and then pressed through a sieve or through calico. In this manner all impurities which may be present are kept back.

3. If tragacanth solution is used it must have been thoroughly boiled and must be perfectly even.

4. For tannic acid prints a sufficient quantity of acetic acid must be added to the printing pastes.

In addition to this it should also be remembered that

the fullest prints are obtained with an acetic acid thickening in which the only thickening agent is starch (thickening C, page 330).

Such thickenings are afterwards difficult to remove and for this reason tartaric acid is added to the printing pastes which converts the starch into dextrine in the steaming process. The latter is soluble and therefore easier to remove.

By adding tragacanth and dextrine to a starch thickening the latter becomes much smoother and also easier to remove afterwards. This has, however, the disadvantage that the prints obtained are lighter in shade.

Additions of glycerine, acetine, olive oil, or castor oil also render the thickenings smoother. The addition of acetine causes the shades to be fuller and faster, as this product is an excellent solvent for dyestuffs.

It is scarcely necessary to add that the engraving of the rollers, their horizontal position and correct adjustment, as also other circumstances play a very important part. Bad results will therefore be obtained although every attention is given to the above-mentioned precautions if any of the factors just enumerated are out of order.

1. General recipes for printing with basic colours.

   a) Without Acetine.

   1 oz. of colour is dissolved by warming in
   10 » » acetic acid 90 Tw. and
   13 » » water. To this are added
   4 lbs. 6 » » thickening A
   3 » » tannic acid
   3 » » acetic acid 90 Tw.
   6 lbs. 4 oz.

   b) With Acetine.

   1 oz. of colour is dissolved by warming in
   5 » » acetic acid 90 Tw.
   5 » » Acetine J and
   13 » » water. To this are added
   4 lbs. 6 » » thickening A
   3 » » tannic acid dissolved in
   3 » » acetic acid 90 Tw.
   6 lbs. 4 oz.

   When preparing the printing pastes the dyestuff is either dissolved in water and
   a little acetic acid (or acetic acid and acetine), and this solution is then mixed with
   the thickening which has already been prepared, or, the thickening agents (starch,
   dextrine, tragacanth solution) are mixed in the colour solution, and boiled with the
   necessary amount of water and acetic acid.
In both cases the tannic acid which is necessary for the formation of the colour lake is dissolved in an equal weight of acetic acid and then slowly stirred into the printing paste, but not until this has cooled down.

After printing, the pieces are dried, steamed for \(\frac{1}{2}-1\) hour without pressure and then worked for 5—10 minutes in a lukewarm solution which contains 4 oz. of tartar emetic to every 10 gallons of water in order to fix the colour completely. They are then rinsed and soaped.

Antimony salt can be used instead of tartar emetic but it has a more acid reaction and therefore attacks metallic vessels to a greater extent. A little chalk is therefore frequently added in order to prevent this.

Notes.

a) Where possible the dyestuffs should be dissolved in distilled water. If this cannot be obtained and ordinary water must be used, it is advisable to correct it before use by adding a little acetic acid \((1\frac{1}{2}-3\) oz. acetic acid 9° Tw. per 10 gallons of water) so as to render the lime present as harmless as possible.

b) The steaming may take place in the Mather-Platt, in the continuous steamer, or in a closed steaming apparatus under pressure.

In the first case the goods only remain for a few minutes in the apparatus without pressure, in the continuous steamer they are treated for a longer period and the temperature of the steam is higher. In the closed steamer they are generally steamed for \(\frac{1}{2}-1\) hour. The pressure in the latter case varies, but as a rule it is only small.

The above-described printing paste 1a is used for all basic colours with the exception of Flavinduline and Induline Scarlet.

This paste can also be used for the Vesuvine and Chrysoidine brands. They are, however, not extensively used for calico printing as they are not very fast to washing and steaming.

Goods printed with Auramine or Methylene Blue are best steamed without pressure.

The printing paste 1b is specially adapted for working with Flavinduline O and Induline Scarlet.

It also gives excellent results with all the other basic dyes with regard to evenness, fulness, clearness, and fastness of shade.

When working with Flavinduline O it is best to steam without pressure.
2. Special recipes.

a) Printing recipe for Indoine Blue.

3 oz. of Indoine Blue powder are dissolved by warming in 6 » » Acetine J and to this are added
5 lbs. 2 » » thickening A
4 1/2 » » tannic acid dissolved in
4 1/2 » » acetic acid 9° Tw.

6 lbs. 4 oz.

Note.

When working with Indoine Blue the use of Acetine is indispensable. For light shades about 6 oz. and for dark shades 20 oz. of Acetine J are required per 100 oz. of printing paste.

b) The following printing paste is also used:—

6 oz. of Indoine Blue powder are dissolved by warming in 10 » » Acetine J and to this are added
4 lbs. 5 » » thickening A and
7 1/2 » » tannic acid dissolved in
7 1/2 » » acetic acid 9° Tw.

6 lbs. 4 oz.

When steaming Indoine Blue it is advisable to do so without pressure.

The following colours are specially adapted for shading Indoine Blue:—

Methylene Blue, Rheonine A, also the various Methyl Violets. (The latter for coppery blue shades).

It must also be remembered that when working with Indoine Blue (as also with a series of other basic colours) the consistency and composition of the thickening have a decided influence on the fullness and shade of the prints obtained.

Very varying depths of shade may therefore be obtained when working with the same quantity of colour but making slight alterations in the method of working.
Good results can also be obtained as we have found by using glycerine in place of acetine. It has, however, the disadvantage that the printing paste is liable to become thick on standing and this renders it difficult to work with.

As a rule $1\frac{1}{2}$ times as much tannic acid as blue is required in order to thoroughly fix the colour. An exception is made when producing dark bronzy shades. In this case in order to obtain the desired redness of shade only $1\frac{3}{4}$ times as much tannic acid as blue is used.

The tannic acid is dissolved in the usual manner in an equal weight of acetic acid $9\%$ Tw.

If in order to obtain more uniform printing pastes the Indoine Blue has to be boiled together with acetine, thickening agents, acetic acid, &c., the operation should be carried out in brass or enamelled vessels. If tin-plated vessels are used, the acetic acid must not be added until the boiling is completed, because in contact with this metal it has a very strong reducing action on the blue. This imparts a more or less reddish cast to the blue, which is very objectionable, especially in light shades.

When steaming Indoine Blue it is not advisable to allow the pressure to rise above $\frac{1}{4}$ atmosphere. It is best to steam without pressure. In order to prevent a partial reduction of the colour taking place (which can easily happen during the steaming process), a little sodium chlorate may be added to the printing paste.

We might mention that Indoine Blue also gives fairly fast prints without tannic acid being used.

c) Printing recipe for Acetine Blue.

\[
\begin{align*}
12 \text{ oz.} \text{ of Acetine Blue R} & \text{ are mixed with} \\
5 \text{ lbs.} & \text{ thickening R and to this are added} \\
4 & \text{"} \text{tannic acid dissolved in} \\
4 & \text{"} \text{acetic acid.} \\
6 \text{ lbs.} 4 \text{ oz.}
\end{align*}
\]

Notes.

Acetine Blue, which is insoluble in water, plays a very important part in calico printing on account of its beautiful shade and great fastness.

It can be shaded off as desired with basic dyes and the latter are dissolved either in the Acetine Blue itself or by warming with the Acetine Blue and a part of the thickening.
If large quantities of basic dyes are used for this purpose the amount of tannic acid mentioned in the above recipe must of course be increased. Under certain circumstances as much as 8 oz. are added to each 100 oz. of printing paste.

Acetine Blue also gives fairly fast shades when used alone without any tannic acid.

The time required for steaming Acetine Blue is 1 hour at \( \frac{1}{2} \) atmosphere pressure. If it is used in conjunction with basic colours it should be steamed for 1 hour without pressure.

d) Printing recipe for Cotton Blue.

\[
\begin{align*}
2 & \text{ oz. of Cotton Blue R are dissolved in} \\
5 & \text{ » » acetic acid } 9^\circ \text{ Tw.} \\
6 & \text{ » » Acetine J} \\
4^{1/2} & \text{ » » water. To this are now added} \\
4 & \text{ lbs. 6 » » thickening A} \\
2^{1/2} & \text{ » » tartaric acid solution } 20^\circ /o \\
5 & \text{ » » tannic acid dissolved in} \\
5 & \text{ » » acetic acid } 9^\circ \text{ Tw.} \\
6 & \text{ lbs. 4 oz.}
\end{align*}
\]

After printing dry, steam \( \frac{1}{2} \) hour without pressure, pass through tartar emetic solution, then rinse and soap.

The evenness of prints with Cotton Blue suffers very much if the goods are steamed too long.


\[
\begin{align*}
2 & \text{ oz. of dyestuff are dissolved in} \\
1 \text{ lb. 6 » » hot water and to this are added} \\
4 & \text{ lbs. 6 » » thickening A} \\
6 & \text{ » » chromium acetate } 32^\circ \text{ Tw.} \\
6 & \text{ lbs. 4 oz.}
\end{align*}
\]

Print, dry, steam for 1 hour at \( \frac{1}{4} \) atmosphere, rinse well, and then soap lightly.
In order to produce pure shades with *Victoria Blue* the pieces must be thoroughly soaped. They are therefore worked for 20 minutes at 158°F. in a solution which contains 8 oz. of Marseilles soap to every 10 gallons of water.

Victoria Blue and Indoine Blue also give fairly fast prints without an addition of chrome salts.

f) Printing recipe for *Rhodamine* on a material which has been prepared with an oil-alumina mordant.

Before printing, the dry cotton cloth is worked for 5 minutes in a bath which contains

\[
1 \text{ lb. Turkey-red oil F}
\]

per gallon of water. It is then squeezed out and dried at a low temperature.

The material is now worked for 5 minutes in a bath of acetate of alumina at 7 \(\frac{1}{2}\)° Tw. and again squeezed out and dried.

(If yellowish shades are desired the pieces are again passed through the old oil bath to which a little ammonia is added and again dried.)

The cloth which has been prepared in this manner is printed with the following paste:—

\[
\begin{align*}
\frac{1}{2} \text{ oz. of Rhodamine B, G or 6 G is dissolved in} \\
1 \text{ lb. } &8\frac{1}{2} \rightarrow \text{ hot water. To this are now added} \\
4 \text{ lbs. } &6 \rightarrow \text{ thickening A and} \\
5 \rightarrow &\text{ acetate of alumina } 15° \text{ Tw.}
\end{align*}
\]

\[
6 \text{ lbs. } 4 \text{ oz.}
\]

Dry, steam for 1 hour, rinse, &c.

**Notes.**

The addition of acetate of alumina to the paste increases the brilliancy of the prints. If this is of little consequence the addition can be omitted.

The prints can be rendered faster to washing by using Caseine thickening Q in place of the thickening A mentioned in the above recipe.
3. General recipe for printing with acid dyes.

On oiled cloth.

The cloth is prepared before printing by passing it through a solution of

56 oz. of Turkey-red oil D
2 » » ammonia
5 gallons of water

after which it is completely dried.

It is now printed with a paste containing

2 oz. of dyestuff dissolved in
10 » » hot water, to which are then added
4 lbs. 6 » » thickening E
18 » » acetate of alumina 30° Tw.
6 lbs. 4 oz.

After drying, steam 1/2 hour at 1/2 atmosphere pressure. The pieces must not be rinsed as the prints are not fast to water.
4. Special recipes for acid dyes.

a) If Soluble Blue and Nigrosine are not to be printed on oiled cloth as above described, process 1b, page 337, (basic colours with tannic acid and acetine) can be used.

After printing, dry, steam, pass through tartar emetic, rinse and, if necessary, soap lightly as described.

b) For Alkali Blue.

Printing paste.

1 oz. of colour is stirred into
3 » » cold water and then warmed on the water bath,
15 » » hot water is now added and then
4 lbs. 6 » » thickening A
5 » » Acetine J, and finally
3 » » tannic acid dissolved in
3 » » acetic acid 9° Tw.

6 lbs. 4 oz.

Print, dry, steam for 1 hour without pressure, pass through tartar emetic, rinse and, if necessary, soap lightly.

Alkali Blue and Soluble Blue do not possess any high degree of fastness to washing, but on the other hand they are fast to light.
5. General printing recipe for colours of the Eosine group.

a) With an addition of acetate of alumina.

2 oz. of colour are dissolved in
1 lb. 7 » » hot water. To this are now added
3 lbs. 12 » » thickening E
5 » » acetate of alumina 15° Tw.
10 » » acetate of magnesia 15° Tw.

6 lbs. 4 oz.

Print, dry, steam for 1/2 hour at 1/2 atmosphere pressure, but do not rinse.
The prints obtained in this manner are not fast to water.

b) With an addition of acetate of chrome.

Process 2e, page 341, is used. (Certain basic dyes printed with an addition of acetate of chrome.)

The shades of the prints obtained in this manner are duller than those which are produced by process 5a, but they are comparatively fast to washing and light.

6. General recipe for substantive dyes with albumen.

2 oz. of colour are dissolved in
1 lb. 9 » » hot water. To this are added
3 » » glycerine
4 lbs. 6 » » egg albumen 1:1 (or blood albumen) and
6 lbs. 4 oz. the mixture is well stirred.

Print, dry, and steam for 1/2 hour without pressure (or at 1/4 atmosphere) and rinse well.

Note.
If the printing paste froths too much add 3 oz. of terpentine.
7. Special printing recipe for Cotton Yellow GI

with an addition of chrome salts.

Process 2 e, page 341, is used, (certain basic dyes printed with an addition of acetate of chrome), but only 2 oz. of acetate of chrome $32\frac{1}{2}$° Tw. is used for $1\frac{1}{2}$ oz. Cotton Yellow GI (more than this cannot be dissolved in 6 lbs. 4 oz. of printing paste) as the printing paste gelatinises if too much of this fixing agent is used.

8. Special printing recipe for Dark Green in paste.

I. Recipe for producing green shades.

$10$ oz. of Dark Green in paste $50\%$ are dissolved by stirring in

$5$ » » caustic soda $76$° Tw. and

$10$ » » water. To this are added

$4$ lbs. $1$ » » thickening H

$10$ » » pyrolognite of iron $23$° Tw.

$6$ lbs. $4$ oz.

Print, dry, steam for 1 hour without pressure, then rinse and soap.

In dark shades these prints are distinguished by being extremely fast to light.

If in the above process the prints are steamed too long or at too high a pressure the shade of the green will become more or less brown.

Closely connected with the above method of printing are two processes according to which the material is printed with a mordant and then dyed or the dyeing is effected on a discharged mordant.

The advantage of working in this manner is that it is much easier to obtain the desired shade.
a) Coloured effects on a printed mordant:

Print the material with

\[
\begin{align*}
4 \text{ lbs.} & \quad 6 \text{ oz.} \text{ of acetic acid - starch thickening} \\
1 \text{ lb.} & \quad 14 \text{ » } \text{pyrolignite of iron } 23^\circ \text{ Tw.} \\
6 \text{ lbs.} & \quad 4 \text{ oz.}
\end{align*}
\]

dry, age in the usual way in a moist warm ageing room (or steam for 1\(1/2\) hours without pressure in the presence of air) rinse very thoroughly and dye for example with 5 lbs. Dark Green in paste and no other addition.

Enter cold, raise in about \(1/2\) hour to 160° F. and keep at this temperature for \(1/2\) hour.

Finally rinse and soap lightly.

b) Colour effects on a discharged mordant:

Pad the material with the iron mordant prepared as follows:

\[
\begin{align*}
&\text{Into} \\
&10 \text{ oz. of tragacanth solution } 50^\circ/0 \text{ stir} \\
&\quad 10 \text{ » } \text{acetic acid } 9^\circ \text{ Tw. and} \\
&\quad 1 \text{ lb. } 14 \text{ » } \text{pyrolignite of iron } 23^\circ \text{ Tw. Make up with} \\
&\quad 3 \text{ lbs. } 2 \text{ » } \text{water to} \\
&\quad 6 \text{ lbs. } 4 \text{ oz.}
\end{align*}
\]

Dry and print on the following discharge:

\[
\begin{align*}
&2 \text{ lbs. } 3 \text{ oz. of sodium citrate } 53^\circ \text{ Tw. mixed with} \\
&\quad 4 \text{ » } 1 \text{ » } \text{British gum thickening } 40:100. \\
&\quad 6 \text{ lbs. } 4 \text{ oz.}
\end{align*}
\]

Dry and dye with Dark Green in paste as above described.

II. Recipe for producing brown shades with Dark Green in paste.

\[
\begin{align*}
&10 \text{ oz. of Dark Green in paste } 50^\circ/0 \text{ are dissolved by stirring in} \\
&\quad 5 \text{ » } \text{caustic soda } 76^\circ \text{ Tw. and} \\
&\quad 1 \text{ lb. } 4 \text{ » } \text{water. To this are now added} \\
&\quad 4 \text{ lbs. } 1 \text{ » } \text{thickening H.} \\
&\quad 6 \text{ lbs. } 4 \text{ oz.}
\end{align*}
\]

Print, dry, steam for 1 hour without pressure, then rinse and soap.

The prints obtained in this manner are distinguished by possessing conspicuous fastness to washing and the highest degree of fastness to light.

On material prepared with Beta-Naphthol.

The cloth is padded with the following Naphthol solution and dried quickly at 140° F. in the hot-flue.

Beta-Naphthol solution.

15 oz. of Beta-Naphthol are dissolved in
15 » » caustic soda 71/2° Tw.
12 lbs. 8 » » hot water. To this are added
3 » 2 » » Turkey-red oil F (50°/o).

This is well stirred up and then diluted with water to 6 1/4 gallons.

Printing paste.

It is advisable to keep the Nitrosamine solution to which hydrochloric acid has been added quite separate and only to mix such quantities with the thickening as will be used up in 1/2—1 hour.

The sodium acetate is dissolved in the cold thickening.

The advantage of this method of working is that the danger of decomposition is considerably reduced.

No. 1. 8 oz. of Nitrosamine Red in paste is carefully mixed with
2 lbs. 6 1/4 » » cold water.

To this is now added
3 3/4 » » hydrochloric acid 32° Tw. (30°/o).

The mixture is allowed to stand 20—30 minutes and stirred from time to time.

No. 2. On the other hand stir together cold
2 lbs. 14 oz. of thickening H and
4 » » sodium acetate in crystals
until the latter is completely dissolved.

Equal parts of Nos. 1 and 2 are mixed together as required and the paste is forced through a cotton cloth before use.

After printing, dry, rinse, and soap.

Note.

If the above recipe is found to be too weak for producing very full red shades the amount of Beta-Naphthol can be increased up to 4 oz. per gallon of padding liquor. Of course, in this case the amount of caustic soda, Turkey-red oil, Nitrosamine Red, hydrochloric acid, and sodium acetate used must be increased in proportion.

10. Special printing recipe for Aniline Black.

It is not our intention to enter upon a discussion of the many methods which are used for this purpose, but rather to give a few typical processes which give good average results.

I. Aniline Black with copper sulphide.

Example.

10 oz. of wheat starch are mixed to a paste with
10 » » water. To this are added
4 » » dextrine
2 3/4 » » sodium chlorate
3 lbs. 11 3/4 » » water and the mixture is boiled for about 10 minutes.

To this thickening are added whilst still warm
8 » » Aniline salt O (B.A.S.F.)
1/2 » » Aniline oil O (B.A.S.F.), and the mass is stirred until cold. Just before use add
5 » » copper sulphide in paste; make up the mixture to
6 lbs. 4 oz. and print on without delay.
After printing, dry the prints and leave them for 24—36 hours in a moist warm ageing room or steam for several minutes in the Mather-Platt. They are then passed through a hot soda solution, or, if a black is required which will not turn green, they are passed through a 1% solution of bichromate of potash at 160° F., and then soaped and washed.

Note.

If desired the copper sulphide of the above recipe can be replaced by 1/3 oz. of vanadium solution. This is prepared by dissolving 1 oz. of ammonium vanadate in 10 oz. of hydrochloric acid 32° Tw. and 5 lbs. 9 oz. of water.

II. Aniline Black with potassium ferrocyanide.

Example.

Dissolve by stirring:—

4 oz. of sodium chlorate powder
4 1/2 » » potassium ferrocyanide in
2 lbs. 3 » » thickening E or J and
5 » » cold water.

Also dissolve:—

8 oz. of Aniline salt O (B.A.S.F.) in
7 3/4 » » cold water
2 lbs. 3 » » thickening E or J and add
3/4 » » Aniline oil O (B.A.S.F.).

These preparations are mixed together just before use, printed, dried, steamed for 1—2 minutes in the Mather-Platt, passed through hot water, soaped, rinsed and, if necessary, also chromed (1% solution of bichromate of potash at 158° F.).

Note.

Ferrocyanide black is frequently printed on a ground obtained by padding or dyeing the goods with substantive dyes and then steamed, or the material is first printed and then padded with substantive dyes.
Printing of Cotton Yarn.

The general rules of working when printing cotton yarn are the same as those for printing piece-goods.

Where any differences do exist they are due to the different form of the cotton, or to differences in the construction of the printing machine resulting from this. The different uses to which the finished prints are put also causes the demands which are made regarding fastness, &c., to vary and to a certain extent this also influences the method of working.

For producing coloured effects on cotton yarn it is chiefly the basic colours that are used. The prints are steamed in the ordinary way but the treatment with antimony salt or tartar emetic in order to completely fix the colour is frequently omitted.

In order to obtain fast prints it is, of course, advisable to put the yarn through this process, i.e., after steaming to work the yarn for \( \frac{1}{4} \) hour in a lukewarm bath which contains 8 oz. of tartar emetic in every 10 gallons of water. After this it is thoroughly rinsed and then lightly soaped.

The printing is carried out with machines of various construction, one of the best known at the present time being that of Gebr. Donath, Chemnitz.

The recipes which we give are intended for working with machines of this kind. When using other machines, slight alterations in the thickness of the pastes may be required, or other thickenings may be necessary.
General printing recipe for basic colours.

1 oz. of colour is dissolved by warming in
5 » » Acetine J (or, if necessary, glycerine)
15 » » thickening A
1 lb. 9 » » acetic acid 9° Tw. After cooling add
3 » » tannic acid dissolved in
3 » » acetic acid 9° Tw. and dilute with
3 lbs. » » water to
6 lbs. 4 oz.

Print, dry, steam for 1 hour without pressure, pass through tartar emetic, &c.

For printing on yarn all basic colours are used with the exception of Chrysoidine and Vesuvine which are not very suitable for this purpose.

The following give specially fast prints:—


A method which has recently been very extensively used is to print coloured stripes on to a ground which has previously been dyed light shades with substantive dyes.

The printing pastes which are used possess the same composition as those described, but as a rule a larger quantity of colour is used, e. g., 2 oz. instead of 1 oz. Further 1/3 oz. of tartaric acid is also used for 6 lbs. 4 oz. of printing paste.

When dyeing the ground colour it should be noticed that if soap or common salt be added to the dye-bath the printing colour is subsequently liable to run on the yarn. It is therefore better to use Glauber's salt in the dye-bath.

If it is found difficult to produce even dyeings it is advisable to thoroughly boil out the goods before dyeing and to add the Glauber's salt after the colour is almost exhausted.
Wool Printing.

General remarks.

Wool is printed in the form of:—

a) Pieces.
b) Yarn (worsted and carpet yarn).
c) Slubbing (Vigoureux printing).

Preparation of the material.

In all cases the wool must be thoroughly cleansed from grease before it is printed and piece-goods must be prepared in a suitable manner. (In the case of muslin and similar materials it is very important that they should be thoroughly singed as the small projecting hairs do not take up the colour so well and thus cause the prints to appear uneven.)

The wool which has been prepared in a suitable manner can either

a) be printed direct, or
b) be first treated with chlorine, or
c) be prepared with tin, or again
d) be prepared with tin and then treated with chlorine.

The object of the treatments b, c, and d is to increase the affinity of the wool for the colour and to produce brighter shades.
Treatment with chlorine.

This is almost exclusively used for piece-goods, and the method described below is intended for this class of goods. If yarn or slubbing is to be subjected to this treatment, the general rules of working are the same, but considerably smaller quantities of sodium hypochlorite are used.

The following is a strong preparation for 10 lbs. of woollen cloth:

\[
\begin{align*}
\text{chlorine bath} & : \\
& 25 \text{ gallons of cold water} \\
& 2^{1/2} \text{ gills } \text{ sulphuric acid } 168^\circ \text{ Tw. or } 1/4 \text{ gallon ordinary hydrochloric acid } 32^\circ \text{ Tw.} \\
& 4^{3/4} \text{ gallons } \text{ sodium hypochlorite } 1^{1/2}^\circ \text{ Tw.}
\end{align*}
\]

\[
\begin{align*}
\text{acid bath} & : \\
& 30 \text{ gallons of cold water} \\
& 2^{1/2} \text{ gills } \text{ sulphuric acid } 168^\circ \text{ Tw. or } 1/4 \text{ gallon ordinary hydrochloric acid } 32^\circ \text{ Tw.}
\end{align*}
\]

Description of the process.

After the goods have been well wetted out they are entered into the acid and water given above for use in the chlorine bath. They are worked in this for 5—10 minutes, after which the hypochlorite of soda is poured in at some suitable part of the vat.

It is necessary that this should be so effected that the hypochlorite completely mixes with the liquid without the concentrated solution being allowed to come into contact with any part of the cloth. This can be quite easily arranged by allowing the winch to run very quickly and by fixing a perforated partition in the vat behind which the solution of hypochlorite is poured.

During this chlorine treatment the pieces should be kept as much as possible from coming into contact with the air. The winch is therefore placed very near to the surface of the liquid and it is kept running quickly. In this manner the pieces carry a sufficient quantity of liquid with them to keep them covered so long as they remain above the surface. They are thus protected sufficiently from the action of the air.

The desired effect is produced after chloring for one hour. The goods are now lightly rinsed, worked for 1/4 hour in the above-described acid bath, then thoroughly rinsed, after which they are dried at a moderate temperature.

Notes.

1. The treatment which has just been described is a very strong one. If it were made still stronger the affinity of the wool would be somewhat increased, but the ground colour of the wool would become correspondingly yellower.

2. If a weaker process is desired the quantity of sodium hypochlorite is reduced to \(\frac{1}{2}\) and the acid to \(\frac{2}{3}\) of the amount stated above.

3. The proportions which are given in the above recipe refer to work in an ordinary dye-vat. If a system of dollies is used into which hypochlorite and acid continuously flow, the concentration of the liquors can be considerably increased and the goods can be passed through much quicker. In this case it is of course much easier to prevent the goods from coming into contact with the air.

4. A method of treating union goods with chlorine which is said to give good results on a practical scale and which can also be used without alteration for pure woollen goods, has been published by Pokorny. The following is an abstract of this method.

The process is carried out in two jiggers, one of which is covered over with a lid and also fitted with an exhauster in order to remove excess of chlorine.

The second jigger is used for rinsing, and for this purpose fresh water is run in continuously.

At the commencement of the operation, jigger No. 1 is supplied with 2 gallons of hydrochloric acid 6° Tw. in 26\(\frac{1}{2}\) gallons of water and about 2\(\frac{1}{2}\) gallons of bleaching powder solution at 6° Tw.

The mixed solution obtained in this manner should stand at 0.9—1° Tw. During the process this solution must be kept up to the same strength and the same level. For this purpose two vessels are connected at the side with the jigger and they are fitted with graduated scales shewing the level of the liquid, so that the workman can observe the rate of flow.

One of these vessels contains 2 gallons of hydrochloric acid 6° Tw. and the other about 2\(\frac{1}{2}\) gallons of bleaching powder solution at 6° Tw., and in both cases the solutions are diluted down to 13 gallons.

These liquids are run into the jigger through two pipes and enter just below the surface of the liquid contained in it. The material should pass
through the jigger in about 15 seconds. It then passes into jigger No. 2, through which a continuous stream of water flows, and after this preliminary rinsing it passes on to the washing machine.

If the material also requires a preparation with tin, it is squeezed out and treated as described below.

Preparation with tin.

The goods are wetted out and then padded with a solution of sodium stannate at $4 \frac{1}{2}^\circ$ Tw., after which they are allowed to hang for 1 hour. They are finally passed through a solution of sulphuric acid at $3^\circ$ Tw., well rinsed and dried.

If it is further desired to give the goods a weak chlorine treatment, then after rinsing they are treated as described under that heading.

Most Aniline dyes give very bright shades on tin-prepared cloth. The shades have, however, not the same depth as those which are produced on chlorine-prepared wool. For this reason both processes are often combined.

Wool which has been subjected to the tin treatment alone is specially adapted for working with colours of the Eosine group. Where this method is used it is chiefly for large blotches.

Choice of thickening agents.

Wheat starch, British gum, dextrine, gum arabic, gum tragacanth, and flour are used for thickening the colour solution.

British gum is highly prized for printing piece-goods as it forms a very smooth, soft thickening and it can be easily removed by washing.

Both tragacanth and British gum are very suitable for printing slubbing.

For printing carpet yarns wheat starch and flour are often used.
Choice of dyestuffs.

The acid colours are naturally the most important for printing wool as their general properties (good average fastness to light, rubbing, &c.) render them specially suitable for this purpose.

In addition to these Eosine, Rhodamine, and certain basic colours are used for special shades. Substantive dyes are also used for a few specialities.

Fixing agents used in printing.

These are acetic, tartaric, and oxalic acids, alum, sulphate of alumina, sodium chlorate, chromium acetate. Of these acetic acid is most generally used. For printing yarn sulphuric acid is also used. (It is not well liked for printing piece-goods as it damages the cotton greys of the printing machine too much.)

An addition of sodium chlorate in combination with tartaric acid, oxalic acid, &c. to the printing paste is generally made when working with wool that has not been treated with chlorine. The object of adding this salt is to counteract the reducing action which is exercised by the wool upon many colours, and when it is used both brighter and better developed shades are obtained. It is specially beneficial in the case of greens, dark blues, blacks, &c.

Acetate of chrome is only used in a few particular cases in order to obtain faster prints.
Steaming after printing.

The steaming which is effected after printing plays the most important part in the fixation and development of the colour. In order that the action may be as complete as possible it is very important that the prints should be sufficiently moist.

The pieces are therefore dried after printing and then rolled up for a short time in a moist cloth.

If the pieces are moistened too much, or,—what comes to the same thing—if the steam used is too moist, the colours will run.

As a rule 1 hour is quite long enough for steaming (for blacks 1 1/2 hours) and if possible the steam should be used without pressure. If these two points are not observed the white of the prints will assume a yellowish tint.

After steaming the goods are thoroughly rinsed, if possible in running water.
Printing Woollen Pieces.

A.

Working on material prepared with chlorine, tin, or chlorine and tin.

1. Suitable printing recipe for acid dyes.

   2 oz. of dyestuff are dissolved in
   3 lbs. 10 » » hot water. Into this are then stirred
   1 » 14 » » British gum and finally
   10 » » acetic acid 90 Tw.
   6 lbs. 4 oz.

Note. The 10 oz. of acetic acid are often replaced by 2 oz. tartaric acid and 1 oz. sodium chlorate, or by 2 oz. of alum.

2. Printing recipe for basic dyes.

   1 oz. of colour
   3 lbs. 11 » » water
   1 » 14 » » British gum
   10 » » tartaric acid solution 20°/o.
   6 lbs. 4 oz.

Note. When full shades are produced with basic colours any white which is left is always more or less stained.

Work as described under 2.

4. Printing recipe for substantive dyes.

As a rule the method of working is the same as that is described under 1 and acetic acid is used.

Note.
In the case of several colours viz:—Cotton Yellow G, GI, GR, GRR, Cotton Red 4 B, Salmon Red, the acetic acid is replaced by a solution of 2 oz. of sodium phosphate in water.

B.

Working on material not treated with chlorine.

1. Printing recipe for acid dyes.

2 oz. of dye
3 lbs. 5 » » water
1 lb. 14 » » British gum
10 » » tartaric acid solution 20%
5 » » sodium chlorate solution 20 %.
6 lbs. 4 oz.
2. Printing recipe for basic dyes.

Work as above described for acid dyes.

Note.

In the case of *Rhodamine* and *Victoria Blue* no sodium chlorate is added.

As a general rule when working with basic dyes the white is not stained nearly so much when unprepared wool is used as when the wool has been prepared with chlorine.

3. Printing recipe for colours of the Eosine group.

2 oz. of dye
3 lbs. 10 » » water
1 lb. 14 » » British gum
10 » » tartaric acid.
6 lbs. 4 oz.

4. Printing recipe for substantive dyes.

Work as described under 1 for acid dyes.

Note.

With *Cotton Yellow G, GI, GR, GRR, Cotton Red 4 B, Salmon Red*, 2 oz. of sodium phosphate is used instead of tartaric acid and sodium chlorate.
Several-colour effects

produced by printing on one side of previously dyed thick woollen cloth, hat-felt, &c.

This method is shortly described here as it is of interest in a few branches of the industry.

The material can either be first chlored and then dyed, or, better still, it can be dyed and then chlored. In the latter case the colours used must of course be such as will resist the chlorine treatment.

As an example we give the following recipe which is used in actual practical work:—

The material is first dyed olive with Wool Green S, Fast Yellow, and Azocarmine G. It is then subjected to the chlorine treatment (process on page 354) after which one side of it is printed with the following black:—

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<tr>
<td>14 lbs. 6 oz. of Brilliant Black BD</td>
<td>2 » 3 » » Light Green SF yellow shade</td>
<td>2 » 3 » » Fast Yellow</td>
<td>54 » 11 » » British gum</td>
<td>4 » 6 » » sodium chlorate</td>
<td>4 » 6 » » tartaric acid</td>
<td>136 » 9 » » water.</td>
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<td>218 lbs. 12 oz.</td>
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It is then dried, steamed for 1/2 hour with little pressure (at the most 1/4 atmosphere) with moist steam.

(If the necessary care is taken piece-goods may be steamed on the finishing rollers.)

Note.

When printing previously dyed material the pressure of the rollers and the nature of thickening must be so arranged that the colour does not penetrate through the material. (For discharge effects on dyed goods which have been printed on one side, see page 425.)
The Printing of previously dyed Woollen Plush.

For this purpose special kinds of plush with long pile are used.

The plush is dyed in the ordinary manner with suitable acid dyes, slightly chlored, and then the ends of the fibres are brushed over, or printed, with a thickened colour solution. After drying it is steamed with moist steam and rinsed.

Example.

Black tips on grey or light brown ground.

Dyeing the plush.—Dye with Wool Green S, Fast Yellow Y, and Sorbine Red.

Brushing on, or printing, the tips.—Use a thickened solution of Brilliant Black BD.
Printing Woollen Yarn.

Before printing the yarn is washed in the ordinary way and sometimes also bleached. The yarn is not subjected to the chlorine treatment, if it can be avoided, as this causes the colour to bleed more or less into the white when rinsed.

For thickening the printing colour the same materials are used as for woollen cloth.

As fixing agents, acetic, oxalic acid, aluminium sulphate, and sodium chlorate are used, and frequently also sulphuric acid.

The yarn is steamed in the moist condition without pressure. For this purpose specially constructed yarn steamers are used in which the prints remain for 1/2—1 hour.

1. Printing recipe for acid dyes.

On unchlored yarn.

2 oz. of dye
3 lbs. 5 » » water
1 lb. 14 » » tragacanth solution 5\% 
10 » » tartaric acid solution 20\%
5 » » sodium chlorate solution 20\%.

6 lbs. 4 oz.

Note.

In place of tartaric acid 10 oz. acetic acid 9\% Tw. or 2 oz. sulphate of alumina may be used.
2. **Printing recipe for basic dyes.**

Work as described for acid dyes.

3. **Printing recipe for colours of the Eosine group.**

   2 oz. of colour  
   3 lbs. 10 » » water  
   1 lb. 14 » » tragacanth solution 5%  
   10 » » tartaric acid solution 20%.  
   6 lbs. 4 oz.

4. **Printing recipe for substantive dyes.**

Work as described under 1 for acid dyes.

**Note.**  
In the case of *Cotton Yellow G, GI, GR, GRR, Cotton Red 4B, Salmon Red*, 2 oz. sodium phosphate are used instead of tartaric acid and sodium chlorate.
Special recipe for Carpet Yarn Printing.

1. Printing recipe for acid dyes.

On unchlored yarn.

2 oz. of dye are dissolved by warming in
1 lb. 7 » » water. Into this are stirred
3 lbs. 2 » » thickening K
10 » » sulphate of alumina 20 %
5 » » sodium chlorate solution 20 %
10 » » oxalic acid solution 10 %

6 lbs. 4 oz.

2. Printing recipe for basic dyes.

Work as described above for acid dyes.

3. Printing recipe for dyes of the Eosine group.

2 oz. of dye
2 lbs. 6 » » water
3 » 2 » » thickening K
10 » » tartaric acid solution 20 %

6 lbs. 4 oz.
4. Printing recipe for substantive dyes.

Work as described under 1 for acid dyes.

Note. In the case of Cotton Yellow G, GI, GR, GRR, Cotton Red 4B, and Salmon Red, 2 oz. sodium phosphate are added instead of sulphate of alumina, sodium chlorate, and oxalic acid.

Special recipe for Printing Slubbing.

1. Printing recipe for acid dyes.

On unchlored material.

2 oz. of dye
1 lb. 7 » » water
3 lbs. 2 » » British gum thickening (1 part British gum, 2 parts water)
10 » » sulphate of alumina 20\%o
5 » » sodium chlorate solution 20\%o
10 » » oxalic acid solution 10\%o.
6 lbs. 4 oz.

2. Printing recipe for basic dyes.

Work as described for acid dyes.
3. Printing recipe for dyes of the Eosine group.

2 oz. of dye
2 lbs. 6 » » water
3 » 2 » » British gum thickening (1 part British gum, 2 parts water)
10 » » tartaric acid solution 20 %.
6 lbs. 4 oz.

4. Printing recipe for substantive dyes.

Work as described for acid dyes.

Note.

In the case of Cotton Yellow G, GI, GR, GRR, Cotton Red 4 B, and Salmon Red, use 2 oz. of sodium phosphate instead of sulphate of alumina, sodium chlorate and oxalic acid.

Slubbing is steamed in the same manner as woollen yarn (page 364).
Silk Printing.

General Remarks.

Silk is printed both in the piece and in the hank. In the latter case the printed hanks are chiefly used for the warp and weft of the so-called Chine and Jaspe goods.
Printing of Silk Piece-Goods.

This may be done on the roller printing machine or by hand with printing blocks. The recipes given below are intended for machine printing, but they can also be used for the hand method if the thickness of the pastes is altered according to the size of the pattern.

Preparation of the silk.

With the exception of boiling-off, the silk does not as a rule need any preparation in order to increase its affinity for Aniline dyes.

Choice of dyestuffs.

The acid and basic dyes are the colours which are most extensively used for printing silk. The Eosine dyes are also employed, and in cases where special demands are made with regard to fastness, the substantive and spirit colours are used.
Thickening agents.

Besides tragacanth and British gum, gum arabic is largely used for printing silk. The latter gives the most even prints, and in addition it is the easiest to wash out.

Fixing agents used in printing.

For acid dyes acetic and tartaric acids are generally used. Basic colours which require to be rendered faster to soap and water can be fixed with tannic acid.

Acetic acid is employed for substantive dyes, but for products which are sensitive to acids it is replaced by sodium phosphate.

Steaming after printing.

The goods are first dried after printing and then they are generally steamed for 1 hour without pressure. After this they are thoroughly rinsed, if possible in running water.

If tannic acid has been used in the printing paste the steamed goods are passed through a bath of tartar emetic before they are rinsed.

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Printing recipes.

1. For acid dyes.

1 oz. of dye is dissolved by warming in
1 lb. 13 » » water. Into this are stirred
4 lbs. 1 » » thickening F and
5 » » acetic acid 9° Tw.
6 lbs. 4 oz.

Note.
In the case of Alkali Blue and Soluble Blue it is advisable to replace the acetic acid by 2 oz. tartaric acid and also to add 5 oz. Acetine J. The latter always brings about better solution and distribution of the colour.

2. For spirit colours.

1 oz. of dye is dissolved by warming in
5 » » Acetine J. Into this are stirred
5 lbs. » » thickening F
5 » » acetic acid 9° Tw.
9 » » water.
6 lbs. 4 oz.

Note.
When working with colours which are difficultly soluble, if necessary, a larger quantity of acetine must be used, and the whole printing paste warmed.
3. For substantive dyes.

1 oz. of dye is dissolved by warming in
4 lbs. 2 » » water. To this are added
1 lb. 12 » » British gum and finally
5 » » acetic acid 9° Tw.

6 lbs. 4 oz.

Notes.

1. In the case of Cotton Yellow G, GI, GR, GRR, Cotton Red 4 B, Salmon Red the acetic acid is replaced by 2 oz. of sodium phosphate.

2. As the prints obtained with substantive dyes are somewhat hard in feel on account of the thickening employed, they are more generally used for producing small patterns than for large blotches.

The chief advantage of the substantive dyes is that their average fastness to water is good.

4. For basic dyes.

a) Without tannic acid.

1 oz. of dye is dissolved by warming in
1 lb. 13 » » water. Into this are stirred
4 lbs. 1 » » thickening F and
5 » » acetic acid 9° Tw.

6 lbs. 4 oz.

Note.

In the case of Flavinduline O, Induline Scarlet, and Indoine Blue it is advisable to also add 5 oz. of Acetine J in order to bring about solution.
b) With tannic acid.

1 oz. of dye is dissolved by warming in
15 » » acetic acid 9° Tw and
13 » » water. To this is now added
4 lbs. 1 » » thickening F and after cooling a solution of
3 » » tannic acid in
3 » » acetic acid 9° Tw.
6 lbs. 4 oz.

Notes.

1. The method 4 b is only employed when the great fastness to water and soap of the prints thus obtained is of importance.

The following colours are specially adapted:—


2. The amount of tannic acid added to the printing paste depends on the quantity of dyestuff used. On an average 1 part of dyestuff requires about 3 parts of tannic acid.

3. After steaming, the pieces are passed through a bath which contains 4 oz. of tartar emetic to every 10 gallons of water. They are then thoroughly rinsed.
The general rules of working are exactly the same as when printing silk piece-goods. The printing pastes are, however, kept considerably thinner by using a smaller quantity of thickening agent.

For example, in recipe 1, page 372, the 4 lbs. 1 oz. of thickening F is replaced by 1 lb. 14 oz., so that the recipe takes the following form:

1 oz. of dyestuff
4 lbs. » water
1 lb. 14 » » thickening F
5 » » acetic acid 9° Tw.
6 lbs. 4 oz.
Printing of materials consisting of Cotton and Silk.

For printing materials consisting of cotton and silk the basic dyes are generally used. They are fixed by adding tannic acid to the printing paste and steaming the prints for 1 hour without pressure. After this they are passed through a solution of tartar emetic, rinsed well, and, if necessary, soaped lightly.

Recipe 4b, page 374, may be taken as an example of a suitable printing paste.

Substantive dyes can be printed on to materials consisting of cotton and silk according to recipe No. 3, page 373.
Printing of materials consisting of Wool and Silk.

(Gloria, &c.)

The best results on materials consisting of wool and silk are obtained with acid—or substantive—dyes.

The thickening agents used are tragacanth, British gum, and gum arabic.

The same fixing agents are used as when printing unchlored woollen cloth.

The prints must be steamed whilst moist; they are therefore dried as when working with woollen cloth, and then damped and steamed for \( \frac{1}{2} \)-1 hour without pressure. After this they are thoroughly rinsed in flowing water.

Printing recipe for pieces consisting of wool and silk.

For acid and substantive dyes.

1 oz. of dyestuff is dissolved by warming in

\[
\begin{align*}
3 \text{ lbs.} & \quad 11 \quad \Rightarrow \quad \text{water. Into this are stirred} \\
1 \text{ lb.} & \quad 14 \quad \Rightarrow \quad \text{British gum and} \\
10 & \quad \Rightarrow \quad \text{acetic acid } 9^\circ \text{ Tw.} \\
6 \text{ lbs.} & \quad 4 \text{ oz.}
\end{align*}
\]
Printing of Union Pieces.

(Wool and Cotton.)

This branch deals with two classes of article:—

1. The printing of white unions (ladies' dress material, union felt, &c).

2. The printing of heavy, previously dyed material which as a rule contains shoddy and is generally used for men's clothing.

These latter articles, which are generally discharged, are more fully described on page 428.
Printing White Unions.

Preparation.

In order to obtain thoroughly even prints on white union goods in which the cotton and wool run side by side and are both visible it is advisable to subject them to the chlorine treatment described on page 354.

Choice of dyestuffs.

If goods of this kind have to be fast to washing to any degree, only basic and substantive dyes can be used, as the acid dyes are not fixed by the cotton.

If, however, the material has been woven or felted in such a manner that the right side of the pieces consists of pure wool, dyestuffs of all kinds can frequently be used.

Union goods of this class are printed in exactly the same manner as pure wool.
Choice of thickening agents.

The most suitable are British gum, tragacanth solution, and starch thickening.

Fixing agents added to the printing paste.

The same fixing agents are used as for pure wool, viz:—for basic dyes, tannic acid dissolved in acetic acid is added and the prints are passed through a solution of tartar emetic after steaming.

When working with substantive dyes a little acetic acid is generally added to the printing paste.

In the case of several products this is replaced by sodium phosphate.

Steaming after printing.

The pieces are steamed in the same way as pure wool, being rendered slightly moist and then steamed for 1 hour without pressure. They are then thoroughly rinsed and this is best carried out in flowing water, especially if substantive dyes have been used.

If basic colours are used the pieces are passed through a tartar emetic solution before rinsing, as already described on page 338.
Printing recipes.

1. For basic dyes.

1 oz. of dyestuff is dissolved by warming in
15 » » acetic acid 9° Tw. and
3 lbs. » » water. Into this are stirred
1 lb. 14 » » British gum and, after cooling,
3 » » tannic acid dissolved in
3 » » acetic acid 9° Tw.
6 lbs. 4 oz.

2. For substantive dyes.

1 oz. of dyestuff is dissolved by warming in
4 lbs. » » water. To this are added
1 lb. 14 » » British gum and
5 » » acetic acid 9° Tw.
6 lbs. 4 oz.

Note.

When working with substantive dyes which are sensitive to acids (e.g., Cotton Yellow G, GI, GR, GRR, Cotton Red 4 B, Salmon Red) the acetic acid is replaced by sodium phosphate.
Discharge and Resist Printing.
The most important methods are:

1. Discharging with zinc dust.
2. Discharging with tin crystals.
3. Discharging with chlorates.
4. Discharging with permanganate.
5. Discharging with alkalies.
6. Resist printing.

Which of the above methods is employed depends entirely upon the nature of the material and the Aniline colour which one has to use in order to produce certain shades or effects.

It would require too much space to give a full description of the various discharges and methods which are used. We therefore only give typical examples of the various discharges and resists and mention those methods of working which differ from those of ordinary printing.

Note.

It should be mentioned here that instead of the zinc dust discharge (zinc dust and sodium bisulphite) a discharge can be used which contains solid hydro-sulphite compounds. These products and the process are patented to us.
Discharge printing on Cotton Piece-Goods.

1. Zinc dust discharges.

A. White discharges on shades which have been produced with basic or substantive dyes.

Zinc dust white discharge 1. For light and medium shades.

1 lb. 14 oz. of zinc dust (finest sifted) are mixed to a paste with
2 lbs. 13 » » thickening F and
3 » » glycerine. These are well stirred together and after cooling
15 » » sodium bisulphite 73° Tw. and
7 » » water are added.
6 lbs. 4 oz.

Zinc dust white discharge 2. For full shades.

2 lbs. 13 oz. of zinc dust
2 » 3 » » thickening F
3 » » glycerine
15 » » sodium bisulphite 73° Tw.
2 » » water.
6 lbs. 4 oz.

(Mix together as above described.)

After printing, dry, steam for 1 hour without pressure, rinse with water containing 8 oz. sulphuric acid 168° Tw. per 100 gallons of water, rinse well and, if necessary, soap lightly.
Notes.

1. When working with *Cotton Yellow G*, *GI, GR, GRR, Cotton Red 4B*, and *Salmon Red*, the rinsing with acid must be omitted.

2. A pure white that is permanent can only be obtained in very few cases, e.g., with dyeings produced with *Auramine, Cotton Yellow GI, Pyramine Orange 3G, R, Cotton Red 4B, Oxamine Blue B, Phenamine Blue, Oxamine Maroon*. As a rule the white discharges become more or less tinted after the goods have been for some time exposed to the action of the air and of light. This is especially the case with basic colours, e.g., *Rhodamine, Diamond Magenta, Methyl Violet*, &c.

Several colours do not give a pure white but the shade of the discharged part does not alter on standing. These products are the most suitable for colour discharges. To this class belong:—*Oxamine Red, Oxamine Violet, Oxamine Blue RRR, Cotton Black B, BN, &c.*

Zinc dust white discharge 3. For Nitrosamine Red dyeings.

\[
\begin{align*}
2 \text{ lbs.} & \quad 3 \text{ oz. of zinc dust} \\
2 \quad \text{ » } & \quad 3 \quad \text{ » } \quad \text{ » thickening F} \\
15 \quad \text{ » } & \quad \text{ » Acetine J} \\
15 \quad \text{ » } & \quad \text{ » sodium bisulphite } 73^\circ \text{ Tw.} \\
6 \text{ lbs.} & \quad 4 \text{ oz.}
\end{align*}
\]

After printing, dry, steam for 10 minutes without pressure, rinse, acidify, and then rinse again.
B. Colour discharges on dyeings produced with basic dyes.

Zinc dust colour discharge 1. (Without tannic acid).

2 oz. of dyestuff are dissolved by warming in 13 » » water and 3 » » glycerine. After cooling add 2 lbs. 10 » » thickening F 1 lb. 14 » » zinc dust and 
10 » » sodium bisulphite 73° Tw. 6 lbs. 12 oz.

To obtain good results it is necessary that the colours used in the discharge paste are not, or are only slightly, decomposed (reduced) by it.

The following are suitable for this purpose: — Sulphine. Rheonine A, N. Induline Scarlet. Saffranine T extra, MN. Methylene Blue BG. Nile Blue A, BB.

As there is no single dyestuff which will give a green discharge a mixture of Nile Blue A and Sulphine is used.

Amongst others the following are used for the ground colour: — Rhodamine. Diamond Magenta. Methyl Violet. Victoria Blue. Diamond Green.

The prints produced by these discharge methods are only moderately fast to washing and air.

C. Colour discharges on dyeings produced with substantive dyes.

Zinc dust colour discharge 2 (with tannic acid).

2 oz. of dye are dissolved by warming in
3 » » glycerine
1 lb. 1 » » water and
2 lbs. 3 » » thickening F. After cooling add
1 1/2 » » tannic acid dissolved in
1 1/2 » » acetic acid 9° Tw. and
1 lb. 14 » » zinc dust. Whilst cooling stir in
10 » » sodium bisulphite 73° Tw.

6 lbs. 4 oz.

Steam as described for White discharge No. 2 and then work for about
5 minutes in a bath which contains about

8 oz. of sulphuric acid 168° Tw. and
2 lbs. » tartar emetic

in 100 gallons of water, then rinse thoroughly.

Notes.

When working with Cotton Yellow G, GI, GR, GRR, Cotton Red 4B, Salmon Red, the addition of sulphuric acid to the above-mentioned bath must be omitted.

The colours mentioned in recipe B for use in the printing paste are also suitable in this case. It should be noticed, however, that Sulphine which is mentioned there, being a substantive dye, does not require an addition of tannin or a passage through tartar emetic. As ground colours the substantive dyes mentioned under White discharge 1, page 388, can be used.

In connection with recipes B and C we might also add that colour discharges can be obtained by printing a white discharge on to dyeings that have been produced with a single colour which gives a coloured discharge instead of a white one.

Another method is to produce the ground colour with a mixture of dyes which behave differently towards the discharge, some of them being discharged whilst others are not.

For example, by printing White discharge 1 on to dyeings produced with about 4% of the following colours a good yellow or orange-yellow effect is obtained:

- Cotton Orange G
- Cotton Orange R
- Thiazine Brown G
- Thiazine Brown R
- Cotton Brown RN
- Thiazine Red G
- Thiazine Red R.

Also Sulphine diazotised and developed with:

a) Beta-Naphthol
b) Alpha-Naphthol
c) Oxamine Developer B
d) Oxamine Developer M.

After printing the pieces are treated as described under A, page 387.

By printing "White discharge 1" on dyeings produced with the mixtures given below the following effects are obtained:

Blue pattern on green ground with

1.4% Auramine II
0.8 » Nile Blue A.

Red pattern on brown ground with

0.5% Diamond Green B
2 » Induline Scarlet.

Red pattern on black ground with

1.5% Auramine II
2 » Induline Scarlet
1 » Diamond Green B.

Other effects can be obtained by following the instructions given on page 396.
2. Tin discharge.

A. White discharge on shades produced with substantive dyes.

Tin white discharge 1. For light shades or such as have been produced with products which are easy to discharge.

Into 3 lbs. 2 oz. of thickening M are stirred
   3 » 2 » » acetate of tin 34° Tw.
   6 lbs. 4 oz.

Tin white discharge 2. For medium shades.

Into 3 lbs. 7 oz. of thickening M are stirred
   1 lb. 9 » » acetate of tin 34° Tw.
   21/2 » » tin salt
   2 » » Acetine J (or glycerine)
   151/2 » » water.
   6 lbs. 4 oz.

Tin white discharge 3. For full shades or shades produced with products which are difficult to discharge.

Into 3 lbs. 7 oz. of thickening M are stirred
   1 lb. 4 » » acetate of tin 34° Tw.
   10 » » tin salt
   4 » » sodium acetate
   3 » » Acetine J (or glycerine)
   8 » » water.
   6 lbs. 4 oz.

After printing, the pieces are always dried, steamed for 1/2 hour without pressure, and then well rinsed.
Notes.

1. A trace of Methyl Violet may be added to the above white discharge for tinting the white.

2. The whites produced with a tin discharge are not nearly so pure as those obtained when zinc dust is used, but they are generally pure enough for producing colour discharges.

3. The following substantive dyes amongst others give comparatively good results when discharged as above: — Cotton Yellow G I. Carbazol Yellow. Salmon Red. Cotton Red 4 B. Oxamine Blue B. Phenamine Blue G, B, R.

Tin white discharge 4. (Sulphocyanide of tin discharge.)

To 4 lbs. 1 oz. of thickening M are added
1 lb. 4 » » tin salt
  8½ » » ammonium sulphocyanide
  2½ » » citric acid powdered.
  4 » » water are added and the mixture is
6 lbs. 4 oz. stirred until the ingredients are dissolved.

After printing, dry and then steam for 5—10 minutes (according to depth of shade) in the Mather-Platt. Finally rinse thoroughly.

Notes.

As a general rule Tin discharge 4 does not give a perfectly pure white. The white obtained with the following colours is sufficiently pure for many purposes: —


Shades which have been dyed with an addition of soap or common salt, especially the latter, show a tendency to run when discharged.

For this reason Glauber's salt should be used as a fixing agent when dyeing.
B. Colour discharges on dyeings produced with substantive dyes.

Tin colour discharge 1. For light and medium shades or shades produced with colours which are easy to discharge.

3 oz. of dyestuff are dissolved by warming in 2 lbs. 14 » » thickening G. After cooling add 1 lb. 14 » » acetate of tin 34° Tw. 9 » » tannic acid dissolved in 9 » » acetic acid 9° Tw. and 3 » » citric acid (powdered).

6 lbs. 4 oz.

Tin colour discharge 2. For full shades or shades produced with colours which are difficult to discharge.

3 oz. of dyestuff are dissolved by warming in 2 lbs. 12 » » thickening G. When cold add 1 lb. 14 » » acetate of tin 34° Tw. 2 » » tin salt 9 » » tannic acid 9 » » acetic acid 9° Tw. 3 » » citric acid (powdered).

6 lbs. 4 oz.

In both cases, after printing, the pieces are dried, steamed for about 1½ hour without pressure and then worked for 5 minutes in a bath containing 4 oz. tartar emetic for every 10 gallons of water. They are then rinsed and, if necessary, soaped lightly.

The following colours are not affected, or only slightly so, if used in the above-described discharge:—


As ground colours the substantive dyes mentioned on page 393 under White discharge 1—3, note 3, may be used.
Tin colour discharge 3. Very strong discharge for full shades or shades which are difficult to discharge.

3 oz. of dyestuff are dissolved in
1 lb. 3 » » hot water. To this are added
3 lbs. 7 » » thickening G and, after cooling,
5 » » tin salt
9 » » tannic acid dissolved in
9 » » acetic acid.

6 lbs. 4 oz.

The prints are treated as described under colour discharge 1 and 2.

When using a discharge which contains tin salt, the material is always more or less tendered, so that it should be applied with caution. It is therefore only used in cases in which the discharge obtained with acetate of tin does not suffice.

Tin colour discharge 4 (Sulphocyanide-tin discharge). For very full shades.

1½ oz. of dyestuff are dissolved by warming in
8 » » water and
3 lbs. 7 » » thickening M. After cooling add
10 » » tin salt
5 » » ammonium sulphocyanide
9 » » tannic acid dissolved in
9 » » acetic acid 9⁰ Tw. and
2½ » » citric acid (powdered).

6 lbs. 4 oz.

After printing, dry, steam for 10 minutes in the Mather-Platt, and then work for about 5 minutes in a bath which contains 1 lb. tartar emetic to every 10 gallons of water. Finally rinse well.

The following colours are specially adapted for printing-on in the discharge paste:—


When working with a tin discharge, certain colour effects can be obtained, as described on page 391, by printing the discharge on to a ground that has been dyed with a colour which gives a colour discharge, or by printing it on to a ground which has been dyed with a mixture of colours, the components of which are affected differently by the discharge.
Thus yellow discharges can be produced by the first method by printing a tin white discharge (No. 1 or 2) on to dyeings obtained from

- 4% Cotton Yellow R
- 4 » Thiazine Brown G, R
- 4 » Cotton Brown RN, RV
- 4 » Thiazine Red G, R.

A red discharge can be obtained by printing dyeings of Indoline Blue RN extra with Tin white discharge 3. This red is frequently brightened with Eosine dyes using acetate of chrome as fixing agent.

Colour discharges can be obtained by printing Tin white discharge 1 or 2 (depending on the depth of shade) on to dyeings which have been produced with a mixture of colours and thus discharging one or more of them, e.g.,—

A cream pattern on a maroon ground is produced from a dyeing produced with

- 3% Thiazine Red R
- 2 » Phenamine Blue B.

A yellow pattern on a green ground from

- 3% Sulphine
- 2 » Oxamine Blue B.

In the same way beautiful effects can be produced by printing Tin white discharge 1 or 2 on to a piece which has been grounded in the ordinary way with substantive dyes and then, without rinsing or mordanting, has been topped with basic dyes, that can not be discharged.

In this way one can produce:—

A blue pattern on a green ground with a dyeing of

- 3% Cotton Yellow GI topped with
- 0.8 » Nile Blue A.

A red pattern on a dark brown ground with

- 3% Phenamine Blue B
- 2 » Induline Scarlet.

A violet pattern on a brown ground with

- 2.4% Cotton Red 4 B
- 0.6 » Methyl Violet BB.

A green pattern on a black ground with

- 3 3/4 Cotton Red 4 B
- 2 » Diamond Green B.

3. Chlorate discharges.

A. White discharges on dyeings produced with basic colours.

Chlorate white discharge 1. For light shades or any shades produced with colours which are easy to discharge.

Stir together until dissolved

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>4 lbs. 6 oz. thickening F</td>
<td></td>
</tr>
<tr>
<td>13 1/2 » » water</td>
<td></td>
</tr>
<tr>
<td>1 1/2 » » potassium ferricyanide (powder)</td>
<td></td>
</tr>
<tr>
<td>5 » » sodium chlorate (powder)</td>
<td></td>
</tr>
<tr>
<td>10 » » sodium citrate 52 ø Tw.</td>
<td></td>
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</tbody>
</table>

6 lbs. 4 oz.

Better discharges are produced if China clay is also added but then a brushing arrangement is required when printing.

After printing, dry, steam for about 1/2 hour without pressure, rinse, and soap lightly.

Chlorate white discharge 2. For full shades or shades produced with colours which are difficult to discharge.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>4 lbs. 6 oz. thickening F</td>
<td></td>
</tr>
<tr>
<td>2 » » water</td>
<td></td>
</tr>
<tr>
<td>3 » » potassium ferricyanide (powder)</td>
<td></td>
</tr>
<tr>
<td>10 » » sodium chlorate (powder)</td>
<td></td>
</tr>
<tr>
<td>15 » » sodium citrate 52 ø Tw.</td>
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</table>

6 lbs. 4 oz.

The pieces are treated in the same manner as when using White discharge 1.

Dyeings produced with *Auramine, Flavinduline, Diamond Magenta, Diamond Green, Methyl Violet, Victoria Blue* can be discharged with White discharges 1 and 2.
Chlorate white discharge 3. Specially adapted for medium shades of Indoise Blue.

1 lb. 2 oz. of China clay are mixed with
3 lbs. 7 » » thickening F. To this are added
13 » » sodium chlorate (powder)
7 » » potassium chlorate (powder)
41/2 » » citric acid (powder)
21/2 » » potassium ferricyanide (powder) and the mixture is stirred until all is dissolved.
6 lbs. 4 oz.

After printing, dry, steam for 1 hour without pressure and work for 10 minutes at 120° F. in a solution which contains 4 oz. Marseilles soap to every 10 gallons of water. Finally rinse several times.

B. Colour discharges on shades produced with basic dyes.

Chlorate colour discharge 1 (without albumen).

1 oz. of dyestuff is dissolved by warming in
3 » » glycerine
91/2 » » water and
4 lbs. 6 » » thickening F. To this are added
11/2 » » potassium ferricyanide
5 » » sodium chlorate (powder)
10 » » sodium citrate 52° Tw. and the mixture is stirred until dissolved.
6 lbs. 4 oz.

After printing, dry, steam for 1/2 hour without pressure, rinse well and, if necessary, soap lightly.

If faster prints are required the pieces are passed after steaming through a solution of 8 oz. tannic acid in 10 gallons of water at 78° F. They are then squeezed out and worked for 3 minutes in a bath which contains 4 oz. tartar emetic to every 10 gallons of water after which they are rinsed and soaped lightly.

For printing-on with this discharge paste only those colours can be used which withstand this discharge fairly well, viz:—

*Cotton Yellow R. Rheonine A. Rhodamine 6 G extra. Saffranine T extra. Methylene Blue BG.*

As ground colours those mentioned on page 397 under White discharge 1 and 2 may be used.

Chlorate colour discharge 2 (with albumen).

- 1 oz. of dyestuff is dissolved by warming in
- 3 » » glycerine and
- 2 lbs. 9 » » thickening F. When cold add
- 1 lb. 14 » » thickening O
- 2 » » terpentine
- 10 » » sodium chlorate (powder)
- 3 » » potassium ferricyanide (powder) and
- 10 » » sodium citrate 52° Tw. and stir until completely dissolved.

<p>| | |</p>
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</tr>
</thead>
<tbody>
<tr>
<td>6 lbs.</td>
<td>4 oz.</td>
</tr>
</tbody>
</table>

After printing, dry, steam for about 1/2 hour without pressure, rinse well and, if necessary, soap lightly.

For printing in the discharge paste the colours mentioned under Colour discharge 1 may be used, and as ground colours those given on page 397 under White discharge 1 and 2.

In addition to these large quantities of *Aniline Colour Lakes, Chrome Yellow, Vermilion,* &c. are used.
4. Permanganate discharges.

**White discharges on shades produced with basic or substantive dyes.**

The material which has been dyed and dried is padded with a solution which contains

\[
\begin{align*}
1 \text{ oz. of gum arabic in} \\
6 \text{ lbs. } 3 \text{ » » water} \\
6 \text{ lbs. } 4 \text{ oz.}
\end{align*}
\]

It is then dried and printed with the following discharge paste:

Permanganate white discharge 1.

\[
12 \text{ oz. of finely ground and sieved permanganate of potash} \\
\text{is stirred into} \\
5 \text{ lbs. } 8 \text{ » » alumina hydrate }8.5\%.
\]

\[
6 \text{ lbs. } 4 \text{ oz.}
\]

After printing, dry, rinse, and then work in a solution which contains 1 lb. sodium bisulphite 72° Tw. per gallon of water until the discharged places appear pure white, finally rinse again.

**Note.** Instead of alumina hydrate, sodium silicate 72—76° Tw. can be used as thickening agent, e. g.,—

Permanganate white discharge 2.

\[
12 \text{ oz. of potassium permanganate are stirred with} \\
8 \text{ » » water and} \\
5 \text{ lbs. » » sodium silicate.}
\]

\[
6 \text{ lbs. } 4 \text{ oz.}
\]

The pieces are treated as above described.

With nearly all basic and most of the substantive dyes, a pure white can be obtained by treatment with a permanganate discharge.

The following are not discharged, or only slightly: — Sulphine. Cotton Yellow R. Cotton Orange G, R. Induline Scarlet.

5. Alkaline discharges.

White discharges on shades produced with basic colours.

Caustic white discharge 1. For light shades or shades easy to discharge.

Stir into

\[
\begin{align*}
5^{1/2} \text{ oz. of British gum whilst cooling} \\
5 \text{ lbs. } & \text{ cold caustic soda solution } 76^0 \text{ Tw.} \text{ Then add} \\
10 & \text{ grape sugar} \\
5 & \text{ sodium silicate } 74-76^0 \text{ Tw.,}
\end{align*}
\]

warm the mixture for about 20 minutes at about 158° F., and then stir until cold. Finally make up with water to 6 lbs. 4 oz.

After printing, dry quickly, steam for 1/2 minute in the Mather-Platt, work for two minutes in a solution of 8 oz. hydrochloric acid 32° Tw. in 10 gallons of water and rinse well. Now soap the pieces twice for 5 minutes, the first time cold and the second time at 140° F. in a solution of 4 oz. of soap in 10 gallons of water, then rinse well.

When working with colours which are difficult to discharge, e.g., Saffranine T extra, MN, Victoria Blue B, Methylene Blue BG, Nile Blue A, BB, it is advisable to use a stronger acid bath which contain 2 lbs. hydrochloric acid 32° Tw. in 10 gallons of water.

The following products give a white discharge with this process: —


Caustic white discharge 2. For products which are difficult to discharge.

The dyed material is padded with a solution which contains $2\ 1/2$ lbs. grape sugar per gallon of water, dried, and then printed with the following discharge paste:

- 7 oz. of British gum are stirred into
- 8 » » water and
- 5 » » sodium silicate 72—76° Tw.

To this is now added

- 5 lbs. » caustic soda 76° Tw., the mixture is warmed for 20 minutes at about 160° F., then stirred until cold and made up with water to 6 lbs. 4 oz.

The method of working is the same as that described under White discharge 1.

Discharges in which potassium sulphite is also used resemble the above and for the sake of completeness we describe them here.

6. Potassium sulphite discharges.

A. White discharge on dyeings produced with basic dyes.

Potassium sulphite white discharge.

- 1 lb. 11 oz. of British gum are mixed with
- 3 lbs. 2 » » potassium sulphite 90° Tw.
- 12 » » potassium sulphocyanide and
- 5 » » water. Let stand for 1/4 hour then add
- 6 » » caustic soda 76° Tw.

6 lbs. 4 oz.

After printing, dry, steam for 10 minutes in the Mather-Platt, work in a solution which contains 8 oz. hydrochloric acid 32° Tw. per 10 gallons water, rinse well and soap lightly.

In the above discharge the potassium sulphocyanide can be replaced by an equal quantity of crystallised sodium acetate.

When working with the sulphite discharge, the prints are not so liable to run in the steaming process as when using the grape sugar discharges, so that sharp outlines are more readily obtained, in most cases, however, they do not discharge so completely as the grape sugar discharges. Dyeings produced with Cotton Blue R, Methylene Blue BG are exceptions, as they discharge better with sulphite.

B. Coloured discharges on dyeings produced with basic dyes.

Potassium sulphite colour discharge.

\[
\begin{align*}
2 \text{ oz. of dyestuff} & \text{ are dissolved in} \\
2 \text{ lbs. 4 » » water. Into this are stirred} \\
1 \text{ lb. 12 » » British gum and, after cooling,} \\
6 \text{ » » potassium sulphocyanide} \\
1 \text{ » 9 » » potassium sulphite 90° Tw.} \\
1 \text{ » 14 » » caustic soda 76° Tw.} \\
6 \text{ lbs. 4 oz.}
\end{align*}
\]

The following products are recommended for trial in the printing colour according to this method of discharging: — Induline Scarlet. Saffranine T extra. Oxamine Violet. Oxamine Blue RRR.
7. Resists.

Caustic white resist for basic colours on material which has been mordanted with tannin and antimony.

Pad (or mordant on the jigger) with tannin and then with antimony salt, next print those parts which should appear white with the caustic white discharge described on page 401.

After printing, dry, steam for 1—2 minutes in the Mather-Platt, then work in a solution which contains 8 oz. hydrochloric acid 32° Tw. in 10 gallons of water and rinse well.

Now dye in the ordinary manner with basic Aniline dyes, rinse, and then soap at 113° F. in two baths, allowing the pieces to remain about 10 minutes in each. Only those basic dyes can be used which do not stain the white resist in the soap bath. For this reason for instance Vesuvine and Chrysoidine are excluded.

Tartar emetic white resist for basic dyes.

Print the unmordanted cotton cloth with the following resist:—

15 oz. of tartar emetic (sodium compound) dissolved by warming in

\[
\begin{align*}
5 \text{ lbs.} & \quad 5 \text{ » » thickening L.} \\
6 \text{ lbs.} & \quad 4 \text{ oz.}
\end{align*}
\]

After printing, dry, and print the cloth with basic dyes, dry again, steam for 1 hour without pressure, pass through tartar emetic, rinse, and soap.

The following may be taken as an example of the printing paste used:—

\[
\begin{align*}
1 \text{ oz. of colour} & \quad \text{is dissolved by warming in} \\
5 & \quad \text{acetic acid 9}^\circ \text{ Tw.} \\
5 & \quad \text{Acetine} \ L \ \text{and} \\
13 & \quad \text{water. To this are added} \\
4 \text{ lbs.} & \quad \text{thickening} \ A \\
3 & \quad \text{tannic acid} \\
3 & \quad \text{acetic acid 9}^\circ \text{ Tw.} \\
6 \text{ lbs.} & \quad 4 \text{ oz.}
\end{align*}
\]
Tin white resist with Nitrosamine Red.

The bleached cotton cloth is padded in the ordinary way (see page 348) with Beta-Naphthol solution, dried, and then printed with the following resist:

\[
\begin{align*}
2 \text{ oz. of tartaric acid are dissolved in} \\
2 \text{ lbs. 6 } & \text{»} \text{» hot water. To this are then added} \\
1 \text{ lb. 14 } & \text{»} \text{» British gum and, after cooling,} \\
10 & \text{»} \text{» tin crystals dissolved in} \\
1 & \text{»} 4 & \text{»} \text{» cold water.} \\
6 \text{ lbs. 4 oz.}
\end{align*}
\]

After printing, dry, pass rapidly through the Nitrosamine solution which is described below, squeeze out, rinse immediately and well, soap lightly twice and, if necessary, pass through a solution of bleaching powder.

It is better in effecting the Nitrosamine passage to pass the cloth through padded rollers, one of which dips into the Nitrosamine solution, than to pass the cloth through the solution, as less of the resist is then dissolved off the material and the Nitrosamine solution remains comparatively free from dirt.

Nitrosamine solution.

\[
\begin{align*}
5 \text{ lbs.} & \text{ of Nitrosamine Red are mixed with} \\
37 & \text{»} 8 \text{ oz.} \text{» water at about 68}^\circ \text{ F. Now add} \\
2 & \text{»} 5 & \text{»} \text{hydrochloric acid 30}^\circ \% \text{, stir well and after half an hour— in} \\
& \text{which time the greater part of the precipitate will have} \\
& \text{disappeared—— add} \\
2 & \text{»} 8 & \text{»} \text{sodium acetate crystals. Stir until the latter is dissolved and} \\
& \text{then make up with water to 62 lbs. 8 oz. and filter from} \\
& \text{the undissolved portion.}
\end{align*}
\]
Coloured resist with Nitrosamine Red.

The following resist gives results which are useful for many purposes.

1 oz. of dyestuff is dissolved by warming in
3 lbs. 2 » » thickening A
4 » » glycerine. After cooling stir in
1 lb. 14 » » thickening O or P and
15 » » sodium bisulphite 72° Tw.
6 lbs. 4 oz.

This is printed on to material which has been prepared in the ordinary way with Beta-Naphthol, the pieces are then dried, hung up for several hours in a warm room and steamed for 1 minute in the Mather-Platt. They are finally dyed in the Nitrosamine solution, rinsed, and soaped lightly.

Note.

The following are specially adapted for printing in the above resist:

Resist with Aniline Black (ferrocyanide).

As this branch is very extensive a detailed description cannot be attempted and only a few typical methods are given here.

In most cases the bleached cotton cloth is padded with the following solution of Aniline salt, dried at a moderate temperature, and then printed without delay with a white or colour resist. The pieces are now dried, steamed for 1—2 minutes in the Mather-Platt, rinsed in warm and finally in cold water.

* Sometimes the pieces are soaped, or chromed and then soaped.

Aniline Salt solution.

Example.

On the one hand dissolve

8 oz. of Aniline salt O (B.A.S.F.) in
2 lbs. 91/4 » » cold water and add
3/4 » » Aniline oil O (B.A.S.F.).

On the other hand dissolve

4 oz. of sodium chlorate powder and
41/2 » » potassium ferrocyanide in
2 lbs. 91/2 » » cold water.

Mix these two solutions together shortly before they are required.

White resist with Aniline Black (ferrocyanide).

Example.

1 lb. 4 oz. of acetate of soda are dissolved by warming in
15 » » water and
4 lbs. 1 » » British gum thickening 1:1.
6 lbs. 4 oz.
Coloured resists.

Colour resist 1 with Aniline Black (ferrocyanide).

For substantive dyes.

Example.  
\[2\frac{1}{2} \text{ oz. of dyestuff are dissolved in} \]
\[3 \text{ lbs. 4} \frac{1}{2} \text{ » » hot water. To this are added} \]
\[1 \text{ lb. 14 » » British gum} \]
\[15 » » 
\text{sodium acetate.} \]
\[6 \text{ lbs. 4 oz.} \]

Note.  
The colour effects obtained by this process are only moderately fast to washing.

Colour resist 2 with Aniline Black (ferrocyanide).

For substantive or basic dyes with albumen.

Example.  
\[1—2\frac{1}{2} \text{ oz. of dyestuff are dissolved in} \]
\[1 \text{ lb. 10 oz.—1 lb. 9} \frac{1}{2} » » 
\text{hot water, and to this are added} \]
\[7 » » \text{British gum, and when cold,} \]
\[3 \text{ lbs. 2 » » thickening O or P} \]
\[15 » » 
\text{sodium acetate (powder).} \]
\[6 \text{ lbs. 4 oz.} \]

Colour resist 3 with Aniline Black (ferrocyanide).

For colour lakes, pigment colours, &c.

Example.  
\[1 \text{ lb. 4 oz. of colour lake paste is mixed with} \]
\[2 \text{ lbs. 3 » » British gum thickening 1:1.} \]
\[\text{Into this are stirred} \]
\[2 » 14 » » 
\text{thickening O or P and} \]
\[15 » » 
\text{sodium acetate (powder).} \]
\[6 \text{ lbs. 4 oz.} \]

Notes.  
The effects obtained with Colour resists No. 2 and No. 3 are comparatively fast to washing.

If when working with Colour resists Nos. 2 and 3 difficulty is encountered due to the pastes frothing, 1\(\frac{1}{2}\) oz. of terpentine should be added.
Resists on Cotton Piece-Goods. Coloured resists with Aniline Black.

Colour resist 4 with Aniline Black (ferrocyanide).

Using zinc oxide and basic dyes.

Example.

1 oz. of dyestuff is dissolved in
1 lb. 9 » » acetic acid 9° Tw. and,
9 » » hot water. Into this are stirred
15 » » British gum and, after cooling,
5 » » tannic acid solution (2 tannic acid : 1 water)
15 » » zinc oxide previously mixed with
15 » » thickening F. Finally dissolve in the mixture
15 » » sodium acetate.

6 lbs. 4 oz.

Notes.

Sometimes Resist 4 is printed on to unprepared material and then passed through a solution of Aniline salt. When working in this manner much less sodium acetate can be used and in some cases it can even be omitted entirely.

The effects obtained by both methods with Resist No. 4 are very bright but they are only moderately fast to washing.

Colour resist 5 for Aniline Black (ferrocyanide).

To the Aniline salt solution as described on page 407 add 2 oz. of tannic acid solution (1 tannic acid : 1 water) and print with the following paste.

Example.

2 oz. of dyestuff are dissolved by warming in
5 » » Acetine J
9 » » water and
3 lbs. 12 » » thickening M. To this are added
4 » » tartar emetic and
1 lb. 4 » » sodium acetate (powder) and the mixture is
6 lbs. 4 oz. stirred until dissolved.

Note.

The effects obtained with Colour resist No. 5 are bright and very fast to soap.

— 409 —
Crimped effects on Cotton Cloth.

(Partial mercerisation).

These effects can be produced in various ways and we give a short description of several methods below.

a) The material is printed with a thickening which contains caustic soda, steamed for several minutes in the Mather-Platt, acidified, and rinsed.

If the goods which have been prepared in this manner are dyed in the ordinary way with substantive dyes, the parts which have been printed take up more colour than the remainder of the cloth and in this manner a dark pattern is obtained on a light crimped ground.

The following is an example of an alkaline thickening which is suitable for this purpose.

Stir together, cooling the mixture,

\[
\begin{align*}
5 \text{ lbs. } 10 \text{ oz. of cold caustic soda} & \quad 72 - 76^\circ \text{ Tw. and} \\
10 \text{ » } & \quad \text{British gum.} \\
6 \text{ lbs. } 4 \text{ oz.}
\end{align*}
\]

The mixture is then warmed for about 20 minutes at 158° F., stirred until cold and then made up with water to 6 lbs. 4 oz.

After printing, the goods should only be steamed for a very short time, viz., 1—2 minutes.

b) A second method is to print on certain substantive dyes dissolved in the above alkaline thickening, dry, steam in the Mather-Platt, and then rinse.

The prints obtained in this manner are not, however, specially fast.

Example.

2½ oz. of dyestuff are dissolved by warming in

\[
\begin{align*}
1 \text{ lb. } & \quad 9 \text{ » } \text{water. Into this are now stirred} \\
7^{1/2} \text{ » } & \quad \text{British gum. The mixture is now allowed to cool down and} \\
5 \text{ lbs. } 10 \text{ » } & \quad \text{caustic soda } 76^\circ \text{ Tw. are slowly added.}
\end{align*}
\]

Now warm up to about 158° F. and keep at this temperature until the total weight = 6 lbs. 4 oz.

After printing, steam as described under a.

The following products are adapted for printing on in this thickening:


c) Another process is to print on a suitable thickening agent alone or together with acetate of chrome or albumen and to dry. The pieces are then mercerised in the usual way.

The following can be used as white resists for this method:

**White resist 1.** 4 lbs. 1 oz. of thickening F are stirred into
2 » 3 » » water.
6 lbs. 4 oz.

**White resist 2.** 4 lbs. 1 oz. of thickening F are stirred into
1 lb. 9 » » water and
10 » » acetate of chrome 32° Tw.
6 lbs. 4 oz.

**White resist 3.** 1 lb. 14 oz. of thickening F are stirred into
3 lbs. 2 » » thickening O or P and
1 lb. 4 » » water.
6 lbs. 4 oz.

After printing, dry and, if the ground does not require to be dyed, mercerise without steaming.

If the material is to be dyed with substantive or basic dyes after mercerising it is advisable when using White resists Nos. 2 or 3 to steam after printing.

It can be omitted in the case of White resist No. 1.

The White resist No. 1 gives soft crepons, whereas Nos. 2 and 3 give hard, strongly crimped goods.

The same thickenings can also be used for colour resists, only adding the necessary dyestuffs.

**Examples.**

**Colour resist 1.** 2½ oz. of dyestuff are dissolved in
2 lbs. 1½ » » water and
4 » 1 » » thickening F.
6 lbs. 4 oz.

Colour resist 2. 2½ oz. of dyestuff are dissolved in
1 lb. 6½ » » water and
4 lbs. 1 » » thickening F and to this is added
10 » » acetate of chrome 32° Tw.
6 lbs. 4 oz.

Colour resist 3. 2½ oz. of dyestuff are dissolved in
1 lb. 1½ » » water
1 » 14 » » thickening F and
3 lbs. 2 » » thickening O or P.
6 lbs. 4 oz.

The colours mentioned on page 411 under b can be used for this purpose.
Discharge Printing on Cotton Yarn.

The general principles which apply to discharge printing on cotton piece-goods also hold good for cotton yarn (see page 385 and following pages).

The composition of the printing pastes, &c. varies of course, on account of the different structure of the material and the different action of the printing machines.

A. White discharges.

For shades produced with substantive dyes.

Zinc dust white discharge 4.

1 lb. 14 oz. of zinc dust are mixed with
2 lbs. 3 » » thickening F
5 » » glycerine and
15 » » water. Stir in
15 » » bisulphite 72° Tw. whilst keeping the mixture cool.

6 lbs. 4 oz.

After printing, dry, steam for 1 hour without pressure and rinse until the discharged parts appear sufficiently white.

Pure white discharges can be obtained with dyeings produced with the following colours:—

Discharge Printing on Cotton Yarn. Zinc and caustic white discharges.

Fairly white discharges with:

- **Oxamine Blue R R R.** Violet Black. Cotton Black B, B N.

The above discharge gives yellow effects with the following products:

- **Cotton Yellow R.** Cotton Orange G, R. Thiazine Brown G, R. Cotton Brown RN, RV. Thiazine Red G, R.

It is scarcely advisable to produce other colour-discharge effects with the above zinc dust discharge as the prints thus obtained are not fast and consequently the colour of the ground suffers.

For shades produced with basic dyes.

**Caustic white discharge 3.**

5 oz. of British gum are stirred into
5 lbs. cold caustic soda 76° Tw. whilst cooling the mixture.

To this are now added
10 » grape sugar and
5 » sodium silicate.

| 6 lbs. 4 oz. |

The mixture is warmed for 30 minutes at 158° F. and finally made up with water to 6 lbs. 4 oz.

After printing, dry thoroughly, steam for 1½—1 minute, acidify for 5 minutes in a solution of 3 oz. of hydrochloric acid per gallon of water, rinse well, and then give the pieces two light soapings.

Pure white discharges can be obtained with dyeings produced with the following products:

A fairly pure white is obtained from dyeings produced with:—

_Rheonine A. Intuline Scarlet. Saffranine T extra, MN. Nile Blue A._

The above method is not suitable for producing coloured discharges.

* *

_for shades produced with substantive dyes._

Tin white discharge 5 (sulphocyanide of tin).

Stir together until dissolved

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<td>2 lbs.</td>
<td>3 oz.</td>
<td>5</td>
<td>10</td>
<td>2 1/2</td>
<td>15 1/2</td>
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<tr>
<td>of thickening M</td>
<td>ammonium sulphocyanide</td>
<td>tin crystals</td>
<td>citric acid (powder)</td>
<td>water.</td>
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After printing, dry, steam for 10 minutes without pressure, and rinse well.

The above discharge does not give a perfectly pure white, but a white which is sufficiently pure for many purposes can be obtained from dyeings produced with:—


It should be noted that dyeings produced with the addition of soap, or, more especially, of common salt to the dye-bath show a tendency to bleed when discharged. For this reason Glauber's salt is used as fixing agent in the dye-bath.
B. Colour discharges.

For shades produced with substantive dyes.

Tin colour discharge 5 (sulphocyanide of tin).

3 oz. of dyestuff are dissolved by warming in 10 » » water 
1 lb. 9 » » thickening M. After cooling add 
5 » » ammonium sulphocyanide 
2½ » » tin crystals 
2½ » » citric acid 
9 » » tannic acid dissolved in 
9 » » acetic acid 9° Tw. and 
2 lbs. 2 » » water and stir until dissolved. 
6 lbs. 4 oz.

After printing, dry, steam for 10 minutes without pressure, and then work for 5 minutes in a bath which contains 1½ oz. tartar emetic per gallon. Finally rinse well.

The basic dyes are the most generally used for the printing paste.

The following are specially adapted:—

Methyl Violet. Diamond Green.
The Discharge Printing of Woollen Piece-Goods.

1. Zinc dust discharges.

A. White discharges.

a) For light or medium shades, or shades produced with colours which are easy to discharge, use Zinc dust white discharge 1. (See discharges on cotton, page 387.)

b) For full shades, or shades produced with colours which are difficult to discharge, use Zinc dust white discharge 2 (page 387).

After printing, dry, steam for 1 hour without pressure, rinse, acidify in a bath which contains \(\frac{3}{4}\) oz. sulphuric acid 168° Tw. per 10 gallons water, and then rinse again.

The following dyestuffs can be discharged sufficiently:

Group I.

A pure permanent white is obtained with:

Discharge Printing on Woollen Piece-Goods. Zinc dust white discharges.

Also with the following substantive dyes:—


Group II.

The following also give a pure white, but the action of the air and light causes the colour to return to a certain extent.


Group III.

The following dyestuffs do not give a pure white but a more or less cream-coloured pattern. They can be used in most cases for colour discharges:—

*Fast Brown N. Wool Green S. Brilliant Black and Palatine Black brands. Blue Black B.*

Also the following substantive dyes:—

B. Colour discharges.

a) For light and medium shades Zinc dust colour discharge 1 is used. (See discharge printing on cotton, page 389.)

b) When working with fuller shades a stronger discharge is used, e.g.,

Zinc dust colour discharge 3.

\[
\begin{align*}
2 \text{ oz. of dyestuff} \\
8 \text{ » » water} \\
3 \text{ » » glycerine} \\
2 \text{ lbs. } 3 \text{ » » thickening F} \\
2 \text{ » 8 » zinc dust} \\
12 \text{ » » sodium bisulphite } 72\text{° Tw.} \\
6 \text{ lbs. 4 oz.}
\end{align*}
\]

Note.
In order to obtain fully developed discharge colours it is necessary to prepare the cloth before dyeing, with chlorine, or, what is still better if suitable colours are used, to treat it after dyeing (see recipe page 354).

The following dyestuffs are specially adapted for printing in the Colour discharge pastes 1 or 3:


As ground colours all those mentioned in group I (page 417) and under certain suitable circumstances also those in groups II and III (page 418) may be used.

Colour discharges can also be obtained on wool in the same manner as described for cotton (page 389 and following pages) by discharging one or more of the colours constituting the shade in question.

For example a yellow pattern on a red ground can be obtained by printing Zinc dust white discharge 1 on to a dyeing produced with

\[
\begin{align*}
2 \% \text{ Quinoline Yellow} \\
2 \text{ » Acid Magenta S.}
\end{align*}
\]
Discharge Printing on Woollen Piece-Goods. Tin white discharges.

A yellow pattern on a green ground with
2 9/0 Quinoline Yellow
1/2 » Acid Violet 7 B.

A bluish red pattern on a violet ground with
1 9/0 Azocarmine BX
1 » Acid Violet 7 B.

A bluish red pattern on a black ground with
1 1/2 9/0 Wool Green S
1 1/2 » Acid Violet 6 BN
3 1/2 » Fast Yellow Y
3 » Azocarmine BX.

2. Tin discharges.

A. White discharges on shades produced with acid or substantive dyes.

Tin white discharge 6. For light shades or dyeings produced with products which are easy to discharge.

Into 4 lbs. 1 oz. of thickening M are stirred
15 » » tin crystals
1 lb. 4 » » water.
6 lbs. 4 oz.

After printing, dry, steam for 1/2 hour without pressure, and rinse.

Tin white discharge 7. For full shades, or shades produced with colours which are difficult to discharge.

Into 4 lbs. 1 oz. of thickening M stir
1 lb. 4 » » tin crystals
15 » » water.
6 lbs. 4 oz.

After printing, dry, steam for 1/2 hour without pressure, and rinse.
Discharge Printing on Woollen Piece-Goods. Tin white discharges.

Notes.

1. A little acetate of soda is frequently added to the printing paste to diminish the action of the tin crystals upon the wool.

2. When working with most products tin discharges impart a yellowish tint to the wool and therefore a trace of Methyl Violet is frequently added.

3. As a general rule zinc dust gives a purer white on wool than tin crystals.

The following dyestuffs are discharged sufficiently by the above method.

Group I.

A fairly pure white is obtained with:


Also the following substantive dyes:

**Cotton Yellow GI. Salmon Red. Cotton Red 4 B. Oxamine Blue B.**

Group II.

A fairly good white which is generally sufficient for colour discharges is obtained from:


Also the following substantive dyes:

B. Colour discharges.

Tin colour discharge 6. For light shades or such as are produced with colours which are easy to discharge.

\[
\begin{align*}
2 \text{ oz. of dyestuff are dissolved in} \\
1 \text{ lb. 2 » » hot water. To this add} \\
4 \text{ lbs. 1 » » thickening M} \\
15 » » tin crystals. \\
\end{align*}
\]

6 lbs. 4 oz.

After printing, dry, steam for \( \frac{1}{2} \) hour without pressure, rinse.

Tin colour discharge 7. For full shades or shades produced with colours which are difficult to discharge.

\[
\begin{align*}
2 \text{ oz. of dyestuff are dissolved in} \\
13 » » hot water. To this are added \\
4 \text{ lbs. 1 » » thickening M} \\
1 \text{ lb. 4 » » tin crystals.} \\
\end{align*}
\]

6 lbs. 4 oz.

After printing, dry, steam for \( \frac{1}{2} \) hour without pressure and rinse.

Notes.

1. In order to obtain fully developed discharge colours the material must be treated with chlorine before dyeing, or better still — if suitable dyes are chosen — after dyeing.

2. If desired sodium acetate can be added to the tin crystals colour discharge in order to partially neutralise the tin crystals.

The following dyestuffs are adapted for printing in this discharge under the above conditions, as they are not affected by it, or only slightly:

As ground colour all those mentioned in group I (and under favourable conditions also those in group II) under Tin white discharge 7, page 421, can be used.

Colour discharges can be obtained, by the same method as that described on pages 390 and following pages, by printing Tin white discharge 6 or 7 on to dyeings obtained with the following products:

Yellow effect on orange ground on dyeings obtained from
4\% Cotton Orange G or R.

Yellow effect on red ground on
4\% Thiazine Red G or R.

Yellow effect on brown ground on
4\% Thiazine Brown G or R
4 » Cotton Brown RN or RV.

By discharging one or more dyestuffs, in dyeings produced with certain mixtures of colours, with Tin white discharge 6 or 7, various effects can be obtained, e. g., —

Yellow pattern on a red ground with
2\% Quinoline Yellow
2 » Fast Red B.

Blue pattern on olive ground with
2\% Tartrazine
1/2 » Acid Violet 6 BN.

Green pattern on dark blue ground with
1\% Bluish Green S
1\% » Naphthol Red S.

Red pattern on a dark brown ground with

2 0% Brilliant Black B
3 » Azocarmine BX.

Blue pattern on dark brown ground with

2 0% Fast Yellow Y
1½ » Fast Red AV
1½ » Acid Violet 6 BN.

Chlorate colour discharges.

Good results can also be obtained on pure wool with the discharge described on page 432 (discharge printing on unions).

Appendix.

Nitric acid discharge.

This method is only used for special purposes (e. g., to produce yellow lists on blue or black piece-goods which have been dyed with certain products) and is simply mentioned here for the sake of completeness.

The discharge paste can, for example, be prepared as follows:—

10 oz. of strong nitric acid is mixed with
1 lb. 14 » » water and
3 lbs. 12 » » thickening F.
6 lbs. 4 oz.

After printing, dry, steam for 20 minutes without pressure, and rinse well. (These lists are generally produced by simply smearing with acid and then ironing with a hot iron.)
Discharge printing of previously dyed thick woollen cloth, hat-felt, &c., one side of which has been completely printed over.

The most varied colour effects can be produced by printing a discharge on to the class of goods described on page 362.

For example, by using a suitable discharge paste (such as Tin white discharge 6) it can be so arranged that the colour which has been printed on to the dyed material is completely discharged whilst the ground colour is not affected.

Other effects can be produced by arranging matters so that one or more colours of the ground colour, or of that which has been printed on, are discharged.

Another possibility is to add such colours to the discharge paste as will not be decomposed by it.

Example.

1. Light green pattern on brown ground.

   Inner side of the material: green.

Dyeing.—With Wool Green S and Quinoline Yellow.

Treatment with chlorine.

Printing the right side.—With Naphthol Red S and Fast Yellow Y.

Discharging the right side.—With Tin white discharge 6.
Discharge Printing on Woollen Piece-Goods. Printing over and discharging previously dyed material.

2. Violet pattern on brown ground.
   Inner side of material: yellow.

Dyeing.—With Tartrazine.
Treatment with chlorine.
Printing the right side.—With Acid Violet 3 BN, Fast Yellow Y, and Naphthol Red S.
Discharging the right side.—With Tin white discharge 6.

3. Yellow pattern on black ground.
   Inner side of material: red.

Dyeing.—With Naphthol Red S.
Treatment with chlorine.
Printing the right side.—With Brilliant Black BD.
Discharging the right side.—With Tin colour discharge 6 containing Quinoline Yellow.

Notes.

Sometimes it is not desired to obtain a regular pattern by printing on a tin white discharge, then the right side of the material is sprinkled over irregularly with a solution of tin crystals.

Similar results to those obtained with tin crystals in examples 1, 2, and 3 can, of course, also be obtained with zinc dust white discharge.
Discharging the tips of previously dyed
Woollen Plush.

(For ordinary printing of the tips of Woollen Plush, see page 363).

If discharges are required on this material it is best to use a well-thickened zinc dust discharge, as this gives more beautiful surface discharges than do discharges containing tin crystals which are liable to penetrate too deeply into the pile.

Example.

1. Light cream coloured tips on a black ground.

Dyeing.—With Brilliant Black B or M.
Discharging.—With Zinc dust white discharge 2.

2. Grey or light brown ground with black tips, the extreme ends of which are discharged to a light cream.

Dyeing.—With Wool Green S, Fast Yellow Y, and Sorbine Red.
Printing or smearing of the tips.—With a thickened solution of Brilliant Black BD.
Discharging the ends of the black tips.—With Zinc dust white discharge 2.

3. Grey or light brown ground with black tips, the extreme ends of which are discharged to a red.

Work as described in example 2 but add Induline Scarlet to the zinc dust discharge.
Discharges on Union Piece-Goods.

(Wool and Cotton.)

1. Zinc dust discharges.

A. White discharges on dyeings produced with substantive or acid dyes.

As discharge for light and medium shades use Zinc dust white discharge 1, page 387. (Discharge printing on cotton.)

For full shades use Zinc dust white discharge 2, on same page.

After printing, the goods are treated in the same manner as described for cotton. (In the case of Cotton Yellow GI, Salmon Red, Cotton Red 4B the treatment with acid must be omitted.)

For producing the ground colour the substantive—or acid—dyes mentioned on pages 388, 417, 418 (discharge printing on woollen piece-goods) can be used.
B. Colour discharges on dyeings produced with substantive or acid dyes.

  a) For light or medium shades Zinc dust colour discharge 2 is used. (See discharge printing on cotton, page 390.)

  b) For dark shades the following colour discharge is used:

Zinc dust colour discharge 4.

- 2 oz. of dyestuff
- 10 » » water
- 3 » » glycerine
- 1 lb. 14 » » thickening F
- 11/2 » » tannic acid
- 11/2 » » acetic acid 9° Tw.
- 2 lbs. 8 » » zinc dust
- 12 » » bisulphite 72° Tw.
- 6 lbs. 4 oz.

In both cases the pieces are dried after printing, steamed for 1 hour without pressure, worked in a solution of

- 8 oz. of sulphuric acid 168° Tw.
- 2 lbs. » tartar emetic or antimony salt

in 100 gallons of water and then thoroughly rinsed.

Notes.

1. In the case of Cotton Yellow GI, Cotton Red 4B, Salmon Red the addition of sulphuric acid to the above-mentioned fixing bath must be omitted.

2. The following colours are suitable for printing in the discharge paste:— Rheonine A, N. Induline Scarlet. Saffranine T extra. Methylene Blue B G. Nile Blue A, B B. Sulphine and Nile Blue A as a mixture for a green discharge.

3. The colour discharges on the cotton are always somewhat lighter than on the wool.

4. As ground colours the products mentioned on pages 388, 417, and 418 can be used.
2. Tin discharges.

A. White discharge on dyeings produced with substantive or acid dyes.

Tin white discharge 8. For light and medium shades.

Into 3 lbs. 7 oz. of thickening M stir
1 lb. 4 » » acetate of tin 34° Tw.
15 » » tin crystals
5 » » acetate of soda
3 » » citric acid (powder)
2 » » water.

6 lbs. 4 oz.

Tin white discharge 9. For full shades.

Into 3 lbs. 7 oz. of thickening M stir
1 lb. 9 » » tin crystals
5 » » acetate of soda
3 » » citric acid powder
12 » » water.

6 lbs. 4 oz.

After printing, dry in both cases, steam for \(\frac{1}{2}\) hour without pressure, and rinse.

For dyeing the ground colour the products mentioned on page 421 (discharge printing on woollen piece-goods) can be used.
B. Tin colour discharges on dyeings produced with substantive or acid dyes.

**Tin colour discharge 8.** For light and medium shades.

2 oz. of dyestuff are dissolved by warming in
2 lbs. 15 » » thickening M. When cold add
1 lb. 4 » » acetate of tin 34 ° Tw.
12 » » tin crystals and
4 » » acetate of soda (crystals) and stir in
5 » » tannic acid dissolved in
5 » » acetic acid 9 ° Tw. and
5 » » citric acid (powder).

6 lbs. 4 oz.

**Tin colour discharge 9.** For full shades.

2 oz. of dyestuff
3 lbs. 2 » » thickening M
10 » » acetate of tin 34 ° Tw.
1 lb. 2 » » tin crystals
5 » » acetate of soda
5 » » tannic acid
5 » » acetic acid 9 ° Tw.
5 » » citric acid (powder).

6 lbs. 4 oz.

In both cases the goods are dried after printing, steamed for about 1½ hour without pressure, and then worked for 5 minutes in a solution which contains 4 oz. tartar emetic per 10 gallons of water after which they are well rinsed.

Yellow effects are obtained by printing White discharge 8 or 9 on to dyeings produced with:—


Appendix.

In many cases, union goods are dyed in a special manner and discharged with nitric acid, oxalic acid, &c. (For discharge with nitric acid, see page 424.)
C. Chlorate colour discharges.

These discharges are chiefly used in cases when the zinc dust discharge does not give satisfactory results or is not desired for other reasons.

(The use of tin discharges for unions is very limited, as they only give good results on ground shades produced with substantive or with a few acid dyes.)

Chlorate discharge 3.

Example. \(\frac{1}{2}\) oz. of dyestuff are dissolved by warming in 10\(\frac{1}{2}\) » water
5 » glycerine and
3 lbs. 4 » British gum thickening 1:1.

When cold add
10 » sodium chlorate (powder)
3 » potassium ferricyanide
1 lb. 2 » sodium citrate 52° Tw.
6 lbs. 4 oz.

After printing, dry, steam for 1 hour without pressure, and, if necessary, rinse.

The following products are only slightly affected by the chlorate discharge and can therefore be printed on in the discharge pastes:—


The following can be used for dyeing the ground:—

Discharge
Printing on Silk Piece-Goods.

1. Zinc dust discharges.

A. White discharges.

For dyeings produced with acid, basic, or substantive dyes.

a) For light or medium shades use Zinc dust white discharge 1. (See discharge printing on cotton, page 387.)

b) For full shades Zinc dust white discharge 2 is used (see same page).

After printing, the pieces are dried in both cases, steamed for 1/2 hour without pressure, rinsed, acidified in water which contains 8 oz. sulphuric acid 168° Tw. per 100 gallons and rinsed again.

The following are suitable ground colours:—

Discharge Printing on Silk Piece-Goods. Zinc colour discharges.


Those colours marked * give at first a pure white discharge, but the action of the air and light causes the colour to a certain extent to return.

B. Colour discharges.

For dyeings produced with acid, basic, or substantive dyes, also for colours of the Eosine group.

a) For light and medium shades use Zinc dust colour discharge 1. (See discharge printing on cotton, page 389.)

b) For full shades use Zinc dust colour discharge 3. (See discharge printing on wool, page 419.)

In both cases the pieces are dried after printing, steamed for 1/2 hour without pressure, rinsed, acidified in water containing 8 oz. sulphuric acid 168° Tw. per 100 gallons, and then rinsed again.

The products enumerated above are suitable for dyeing the ground. The following do not give a pure white with the above discharge but still they can be used as the ground for colour discharges: —

The following are suitable for printing in the discharge paste:


Colour discharge effects can be easily obtained from dyeings produced with certain colours, or by discharging one or more of the dyestuffs of which a certain shade is composed. This method of working is quite simple in the case of silk as in many cases acid, basic, and substantive dyes can be dyed together. For this reason it is possible to obtain a very great variety of effects in this manner.

**Examples.**

1. When working with acid dyes and discharging with Zinc dust white discharge 1 or 2 one can obtain:

   A yellow pattern on a red ground from dyeings produced with
   
   \[2\% \text{ Quinoline Yellow} \]
   \[3 \% \text{ Fast Red B.}\]

   A red pattern on a violet ground from
   
   \[1\% \text{ Azocarmine BX} \]
   \[1 \% \text{ Acid Violet 7 B.}\]

   A red pattern on a dark blue ground from
   
   \[2\frac{1}{2}\% \text{ Brilliant Black B} \]
   \[3 \% \text{ Azocarmine BX.}\]

2. When working with basic dyes and discharging with Zinc dust white discharge 1 or 2 one can obtain:

   A pink pattern on a violet ground from a dyeing produced with
   
   \[0.7\% \text{ Victoria Blue B} \]
   \[0.8 \% \text{ Saffranine T extra.}\]

   A red pattern on a navy blue ground from
   
   \[0.4\% \text{ Victoria Blue B} \]
   \[1.5 \% \text{ Saffranine T extra} \]
   \[0.6 \% \text{ Diamond Green B.}\]
Discharge Printing on Silk Piece-Goods. Zinc dust colour discharges.

A red pattern on a brown ground from
2% Auramine II
2 » Induline Scarlet
1 » Diamond Green B.

3. When working with substantive dyes and discharging with Zinc dust white discharge 1 or 2 one can obtain:—

A yellow pattern on a red ground from dyeings produced with
4% Thiazine Red G or R.

A yellow pattern on a brown ground from
4% Thiazine Brown G or R.

A yellow pattern on a scarlet ground from
2% Sulphine
2 » Cotton Red 4 B.

A yellow pattern on a bordeaux ground from
3% Sulphine
3 » Oxamine Violet.

A yellow pattern on a green ground from
3 % Sulphine
1.5 » Oxamine Blue B.

4. When working with a combination of substantive and basic dyes:—

A red pattern on a brown ground from
3% Phenamine Blue B
2 » Induline Scarlet.

A blue pattern on a green ground from
3 % Cotton Yellow GI
0.8 » Nile Blue A.

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Discharge Printing on Silk Piece-Goods. Tin white discharges.

2. Tin discharges.

A. White discharges on dyeings produced with acid or substantive dyes.

Tin white discharge 10. For light and medium shades.

Into 3 lbs. of thickening G stir
3 » 2 oz. » acetate of tin 34° Tw.
2 » » citric acid (powder).
6 lbs. 4 oz.

Tin white discharge 11. For full shades.

To 3 lbs. 7 oz. of thickening G add
1 lb. 4 » » acetate of tin 34° Tw.
10 » » tin crystals
4 » » sodium acetate
3 » » citric acid (powder)
8 » » water and stir until dissolved.
6 lbs. 4 oz.

After printing, dry, steam for 1/2 hour without pressure and rinse well.

The following are suitable for producing the ground colour:

Cotton Yellow G.I. Brilliant Yellow S. Fast Yellow. Metanil Yellow.
The Orange brands. Salmon Red. Silk Red G and R. The Scarlet
The Fast Red brands. Erythrine X, P. Naphthol Red S. Palatine
Blue RRR, B. Blue Black B. Brilliant Black B. Violet Black.
Cotton Black B, B N.
Discharge Printing on Silk Piece-Goods. Tin colour discharges.

B. Colour discharges.

Tin colour discharge 10. For light and medium shades.

2 oz. of dyestuff are dissolved by warming in
2 lbs. 14 » » thickening G. Into this are stirred
3 » 2 » » acetate of tin 34° Tw.
2 » » citric acid (powder).
6 lbs. 4 oz.

Tin colour discharge 11. For full shades.

2 oz. of dyestuff are dissolved by warming in
7 » » water and
2 lbs. 14 » » thickening G. Into this are stirred
2 » 8 » » acetate of tin 34° Tw.
2 » » tin crystals
3 » » citric acid (powder).
6 lbs. 4 oz.

In both cases dry after printing, steam for 1/2 hour without pressure and rinse well.

The following products can be used for printing in the discharge paste:


As ground colours those given under Tin white discharge 10 or 11 can be used.
Coloured effects can be produced by discharging one or more colours of a suitable mixture or by discharging certain single colours with Tin white discharge 10 or 11.

a) Dyeings obtained from substantive dyes.

A yellow pattern on a red ground from
4 0/o Thiazine Red R.

A yellow pattern on a brown ground from
4 0/o Thiazine Brown G or R.

A cream pattern on a maroon ground from
3 0/o Thiazine Red R
2 » Phenamine Blue B.

A yellow pattern on a green ground from
3 0/o Sulphine
2 » Oxamine Blue B.

b) Dyeings obtained from a mixture of substantive and basic dyes.

(For the dyeing of such grounds, see page 396.)

By using Tin white discharge 10 or 11 one can obtain:—

A blue pattern on a green ground from
3 0/o Cotton Yellow GI
0·8 » Nile Blue A.

A red pattern on a brown ground from
3 0/o Phenamine Blue B
2 » Induline Scarlet.

A violet pattern on a claret ground from
2·4 0/o Cotton Red 4B
0·6 » Methyl Violet B B.
Discharge Printing on Silk Piece-Goods. Tin colour discharges.

A green pattern on a black ground from

- 3½ % Cotton Red 4 B
- 2 » Diamond Green B.

c) Dyeings obtained from acid dyes. By using Tin white discharge 10 or 11 one can obtain:

A yellow pattern on a red ground from

- 2½ % Quinoline Yellow
- 3 » Fast Red B.

A green pattern on a steel blue ground from

- 2 % Bluish Green S
- 1½ » Fast Red B.

A red pattern on a dark blue ground from

- 2½ % Brilliant Black B
- 3 » Azocarmine BX.

A blue pattern on a brown ground from

- 2 % Metanil Yellow
- 1½ » Fast Red AV
- 1½ » Acid Violet 6 BN.
3. Resin resists.

The resin and fat resists which are used for silk are prepared in very great variety. The following is an example of one which is simple to work with:—

2 lbs. 8 oz. of resin
2 » » yellow wax
15 » » alcohol

are warmed together until completely dissolved in a vessel fitted with an inverted condenser open at the top.

When cold this mixture is printed on to those parts of the silk which should remain white. A little China clay is then spread over the printed parts, the material is rinsed in cold water, and then dyed for 2—4 hours in a cold bath with suitable Aniline colours.

After dyeing, dry, wash out the resin resist with benzine, and dry.

When working according to the above process, of course only such Aniline colours can be used as will dye the silk in a cold bath. They must be insoluble in benzine or nearly so, so that when the resist is dissolved with benzine the pattern will not be stained.

The following, for example, can be used for this purpose:—

*Vesuvine B. Rhodamine B. Methyl Violet. Diamond Green.*
Discharge Printing on Pieces consisting of Cotton and Silk.

1. Zinc dust discharges.

A. White discharges on shades produced with substantive dyes.

a) For light or medium shades use Zinc dust white discharge 1 (see discharge printing on cotton, page 387).

b) For dark shades use Zinc dust white discharge 2 (see also page 387).

For ground colours the products can be used which are enumerated on page 433. (Zinc dust white discharge on silk.)

B. Colour discharges on shades produced with substantive dyes.

Use Zinc dust colour discharge 2. (See discharge printing on cotton, page 390.)

Note. As the colour which is printed on is not so completely fixed by the cotton as by the silk, one cannot avoid the shade of the latter being deeper than that of the former.
Discharge Printing on materials consisting of Cotton and Silk. Tin white discharges.

For printing-on, the products mentioned on page 389 (Colour discharge 1 on cotton) can be used.

As ground colours also those mentioned on page 389 can be used.

Colour effects can be produced by printing Zinc dust white discharge 1 or 2 on to dyeings obtained from certain single colours just as is the case when working with silk, e. g.,—

Yellow pattern on a red ground with

4\(^9\)/\(^{\circ}\) Thiazine Red G or R.

Yellow pattern on a brown ground with

4\(^9\)/\(^{\circ}\) Thiazine Brown G or R.

2. Tin discharges.

A. White discharges on dyeings produced with substantive dyes.

a) For light or medium shades use Tin white discharge 10 (see page 437).

b) For darker shades use Tin white discharge 11 (see page 437).

As ground colours those mentioned at the same place can be used.
B. Tin colour discharge.

Tin colour discharge 12. For light and medium shades.

2 oz. of dyestuff are dissolved by warming in
2 lbs. 13 » » thickening G. To this are added
2 » 8 » » acetate of tin 34° Tw.
1 » » tin crystals
5 » » tannic acid dissolved in
5 » » acetic acid 9° Tw.
2 » » citric acid (powder).

6 lbs. 4 oz.

Tin colour discharge 13. For full shades.

2 oz. of dyestuff are dissolved in
2 lbs. 11 » » thickening G
2 » 8 » » acetate of tin 34° Tw.
2 » » tin crystals
5 » » tannic acid dissolved in
5 » » acetic acid 9° Tw.
3 » » citric acid (powder).

6 lbs. 4 oz.

After printing, the pieces are dried in both cases, steamed for \( \frac{1}{2} \) hour without pressure, worked in a solution of 4 oz. tartar emetic in 10 gallons of water, and then rinsed well.

The colours mentioned under Tin colour discharge 2 (discharge printing on cotton, page 394) can be used for printing-on.

As ground colours those given on page 437 (Tin colour discharge on silk) can be used.

Colour discharges can also be produced in the manner described on page 391 by discharging one or more dyestuffs from a ground which has been produced from a mixture of acid and substantive dyes or by grounding with substantive dyes and topping with basic dyes.
Pattern-Sheets.

Cotton prints
Wool prints
Silk prints
Prints on materials consisting of Silk and Cotton
Union prints.
Cotton.
Direct prints. White and colour reserves.

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<th>Image</th>
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</thead>
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<tr>
<td>Victoria Blue B.</td>
<td>(Page 352.)</td>
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<tr>
<td>Rheonine A.</td>
<td>(Page 357.)</td>
</tr>
<tr>
<td>Indigine Scarlet.</td>
<td>(Page 337.)</td>
</tr>
<tr>
<td>Rhodamine 6 G.</td>
<td>(Page 337.)</td>
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<tr>
<td>Diamond Green G.</td>
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</tr>
<tr>
<td>Methyl Violet BB</td>
<td>(Page 323.)</td>
</tr>
<tr>
<td>extra.</td>
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</tr>
<tr>
<td>Rheonine A</td>
<td>(Page 337.)</td>
</tr>
<tr>
<td>Saffranine M.N</td>
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</tr>
<tr>
<td>Rhodamine 6 G</td>
<td>(Page 352.)</td>
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<tr>
<td>Methylene Blue B.G.</td>
<td></td>
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<tr>
<td>Accine Blue R.</td>
<td>(Page 343.)</td>
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<tr>
<td>Scarlet 6 R.</td>
<td>(Page 343.)</td>
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<tr>
<td>(Printed on material prepared with Turkey-red oil.)</td>
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<tr>
<td>Victoria Blue B.</td>
<td>(Page 341.)</td>
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<tr>
<td>(Printed with acetate of chrome.)</td>
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<tr>
<td>Rhodamine 6 G.</td>
<td>(Page 342.)</td>
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<tr>
<td>(Printed on material prepared with Turkey-red oil and alumina.)</td>
<td></td>
</tr>
<tr>
<td>Cotton Orange R.</td>
<td>(Page 345.)</td>
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<tr>
<td>(Albumen print.)</td>
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</tr>
<tr>
<td>Nitrosamine Red in paste.</td>
<td>(Page 348.)</td>
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<tr>
<td>Thiazine Red R.</td>
<td>(Page 345.)</td>
</tr>
<tr>
<td>(Albumen print.)</td>
<td></td>
</tr>
<tr>
<td>Ground: Nitrosamine Red in paste.</td>
<td>(Page 405.)</td>
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<tr>
<td>Colour reserve</td>
<td></td>
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<tr>
<td>Methyl Violet BB</td>
<td>(Page 405.)</td>
</tr>
<tr>
<td>extra.</td>
<td></td>
</tr>
<tr>
<td>Ground: Nitrosamine Red in paste.</td>
<td>(Page 406.)</td>
</tr>
<tr>
<td>Colour reserve</td>
<td></td>
</tr>
<tr>
<td>Auramine O.</td>
<td></td>
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</tbody>
</table>
### Cotton.

**Direct prints.** **Discharge prints.** **Reserves.**

<table>
<thead>
<tr>
<th>Paint</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyramine Orange RR. (Zinc white discharge 1.)</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>Nitrosamine Red in paste. (Zinc white discharge 3.)</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Victoria Blue R. (Zinc white discharge 1.)</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>Diamond Green B. (Potassium sulphite white discharge 1.)</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Ethyl Purple 6 B. (Caustic white discharge 3.)</td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
<tr>
<td>Methylene Blue B. (Caustic white discharge 2.)</td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td>Ground: Cotton Yellow G.I.</td>
<td><img src="image7.png" alt="Image" /></td>
</tr>
<tr>
<td>Tin colour discharge 1. with Rhodamine 6 G extra.</td>
<td><img src="image8.png" alt="Image" /></td>
</tr>
<tr>
<td>Ground: Oxazine Blue B.</td>
<td><img src="image9.png" alt="Image" /></td>
</tr>
<tr>
<td>Print: Induline Scarlet.</td>
<td><img src="image10.png" alt="Image" /></td>
</tr>
<tr>
<td>Ground: Induline Blue R.N. extra.</td>
<td><img src="image11.png" alt="Image" /></td>
</tr>
<tr>
<td>Tin colour discharge 4. with Eosine A and acetate of chrome.</td>
<td><img src="image12.png" alt="Image" /></td>
</tr>
<tr>
<td>Ground: Victoria Blue B.</td>
<td><img src="image13.png" alt="Image" /></td>
</tr>
<tr>
<td>Chlorate colour discharge 1. with Rhodamine 6 G extra.</td>
<td><img src="image14.png" alt="Image" /></td>
</tr>
<tr>
<td>Ground: Aniline Black.</td>
<td><img src="image15.png" alt="Image" /></td>
</tr>
<tr>
<td>Colour reserve 5. with Rhodamine 6 G extra.</td>
<td><img src="image16.png" alt="Image" /></td>
</tr>
<tr>
<td>Ground: Acetine Blue R. (Turmeric reserve.)</td>
<td><img src="image17.png" alt="Image" /></td>
</tr>
<tr>
<td>Ground: Aniline Black.</td>
<td><img src="image18.png" alt="Image" /></td>
</tr>
<tr>
<td>Colour reserve 5. with Auramine O.</td>
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### Wool

#### Direct prints

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<tr>
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<th>Scarlet R.</th>
<th>Soluble Blue I.N.</th>
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</thead>
<tbody>
<tr>
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<td>![Image](Page 355)</td>
<td>![Image](Page 355)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Rose Bengal NT.</th>
<th>Bluish Green S.</th>
<th>Acid Magenta S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image](Page 365)</td>
<td>![Image](Page 367)</td>
<td>![Image](Page 359)</td>
</tr>
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</table>

#### Discharge prints

<table>
<thead>
<tr>
<th>Acid Violet 3 B.N.</th>
<th>Brilliant Yellow S</th>
<th>Acid Violet 3 B.N</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image](Page 355)</td>
<td>![Image](Page 357, 417)</td>
<td>![Image](Page 355)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>![Image](Page 355)</td>
<td>![Image](Page 364)</td>
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</table>

<table>
<thead>
<tr>
<th>Printing Blue for Wool.</th>
<th>Thiazine Red R.</th>
<th>Brilliant Black B.D.</th>
</tr>
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<tbody>
<tr>
<td>![Image](Page 355)</td>
<td>![Image](Page 358)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Acid Violet 7 B Azocarmine G.X. (Zinc white discharge 1.)</th>
<th>Bluish Green S. (Zinc white discharge 3.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image](Pages 357, 417)</td>
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</table>

<table>
<thead>
<tr>
<th>Palatine Red A. (Tin white discharge 7.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image](Page 420)</td>
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</tbody>
</table>

Ground: Orange G.  
Tin colour discharge 7 with Acid Violet 4 B.N.  
Bluish Green S  
Naphthol Red S. (Tin white discharge 7.)  
Bluish Green S  
Naphthol Red S. (Tin white discharge 7.)  

Zinc colour discharge 1 with Quinoline Yellow.  
Tin colour discharge 7 with Acid Violet 4 B.N.  
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---

Sheet 19.
Silk. Materials consisting of Silk and Cotton, Unions.

Direct prints. Discharge prints.

<table>
<thead>
<tr>
<th>Soluble Blue I.N.</th>
<th>Rhodamine B.</th>
<th>Diamond Green G.</th>
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</thead>
<tbody>
<tr>
<td>(Page 372.)</td>
<td>(Page 373.)</td>
<td>(Page 374.)</td>
</tr>
</tbody>
</table>

Grounds:
- Silk Red R.

Zinc colour discharge | with Nile Blue BB.

Separate colours:
- Auramine O
- Victoria Blue B
- Rhodamine B extra
- Diamond Green G
- Rhodamine B extra
- Acetine Blue R.

Ground:
- Acid Violet 7 B.

Blue colour discharge | with Quinoline Yellow extra.

Ground:
- Brilliant Yellow S.

Tin colour discharge | with Rhodamine 6 G extra.

Ground:
- Quinoline Yellow.

Print:
- Induline Scarlet
- Victoria Blue B
- Rhodamine B extra
- Crystal Violet
- Diamond Green G
- Acetine Blue R.

Ground:
- Orange II.

Tin colour discharge | with Methyl Violet B.B.

extra.

Ground:
- Thiazine Red R.

Tin colour discharge | with Auramine O.

(extra, Printed with tannin.)

Ground:
- Oxazine Blue B.

Tin colour discharge | with Nile Blue A.

(extra, Printed with tannin.)

Ground:
- Oxazine Red.

(extra, Printed with tannin.)

Ground:
- Auramine II

Diamond Green G.

(extra, Printed with tannin.)

Ground:
- Grounding Black for Cotton
- topped with Light Green S.F.
- blue shade.

Chlorate colour discharge | with Induline Scarlet.

(extra, Printed with tannin.)

Ground:
- Grounding Black for Cotton
- topped with Orange II.

Tin colour discharge | with Crystal Violet.

(extra, Printed with tannin.)

Ground:
- Grounding Black for Cotton
- topped with Sorbine Red.

Tin colour discharge | with Nile Blue B.B.

(extra, Printed with tannin.)
Mordants and Chemicals.
The Mordants and Chemicals used in Dyeing, Printing, &c.

1. Acids.

Acetic acid 9° Tw. (30°/o), C₂H₄O₂, a colourless liquid.

It is used as a fixing agent (also as an assistant) when dyeing wool, cotton, silk, &c. It also serves for correcting hard water, for brightening silk dyeings, for producing acetate of alumina, for adding to the printing pastes in wool, silk, and calico printing.

When used in this way it tends to prevent the separation of tannin or other colour lakes formed in the printing pastes.

Sulphuric acid 168° Tw., H₂SO₄, is a heavy, very corrosive liquid.

In cases where its acid salt, viz., sodium bisulphate, cannot be obtained, it is the most usual addition to the vat when dyeing wool with acid dyes. For the above purpose it should always be used in conjunction with Glauber’s salt.

In the silk dye-house it serves for acidifying the baths which contain “boiled-off” liquor and also for brightening silk. It is also used together with bichromate of potash for mordanting wool. Used in stronger solutions, this mixture is useful for stripping shoddy.

Other uses of sulphuric acid are, for decomposing sodium nitrite for the diazotising process, for souring yarn when bleaching with bleaching powder to liberate the chlorine, for developing Alkali Blue, for decomposing sodium bisulphite in wool bleaching, for acid milling, for removing lime from yarn which has been dyed in the indigo vat, &c.

It is also used in very large quantities for carbonising wool.
Hydrochloric acid 30—34° Tw. (about 30°/o), HCl, a strongly acid solution of hydrochloric acid gas in water.

It is used for dissolving aniline oil for Aniline black dyeing, for souring yarn that is being bleached with bleaching powder, for decomposing Nitrosamine Red, and for decomposing the sodium nitrite used for diazo-tising. It is also used in preference to sulphuric acid for rinsing goods which have been diazo-tised as it does not develop so much heat when mixed with water, and it does not form any difficultly soluble precipitates like sulphuric acid does (due to formation of sulphate of lime with the various lime salts present in the water).

Hydrochloric acid is also added to water which is intended for mordanting, if iron salts be present, &c., in order to render them as harmless as possible.

It is likewise added to the dye-bath when topping materials consisting of cotton and silk with basic colours after they have been grounded with substantive dyes, &c.

Nitric acid, HNO₃, a yellow fuming and strongly corrosive liquid, generally sold at 66° Tw.

It is used in a few cases for stripping shoddy, also for producing yellow lists on woollen pieces which have been dyed with Indigo, &c.

It also serves for bleaching silk (aqua regia bleaching process).

Tartaric acid, C₄H₆O₆, colourless crystals soluble in water.

Tartaric acid is used in silk dyeing for acidifying baths containing “boiled-off” liquor when dyeing delicate shades.

It is added as a fixing agent to the printing pastes used for printing shades on cotton, wool, or silk, &c., which might suffer with another acid. When used in printing pastes containing starch it also possesses the great advantage of converting it into dextrine, thus rendering the thickening much easier to remove when the pieces are rinsed. It also serves as a resist for Nitrosamine Red.

Its acid potassium salt, viz., tartar, is extensively used in conjunction with bichromate of potash for mordanting wool. It also serves for discharging the Alizarine colours.

Sodium bisulphate, sodium acid sulphate, NaH₂SO₄, white lumps soluble in water.

It is used on the largest scale as a fixing agent when dyeing wool with acid colours.
Citric acid, \( C_6H_8O_7 + H_2O \), colourless soluble crystals.

   It is added in special cases to the pastes used for printing silk and cotton.
   In the case of cotton it is used in discharge pastes.

Oxalic acid, \( C_2H_2O_4 + 2H_2O \), slightly yellow soluble crystals.

   It is added in a few cases to the wool dye-vat and is used in fairly large quantities when dyeing with logwood and Aniline colours in one bath.
   It serves for stripping shoddy either alone or in combination with bichromate of potash and sulphuric acid. It can also be used as a cheap substitute for tartar when mordanting wool with bichromate of potash.
   It is also employed in a few special cases for wool printing.

Lactic acid \( 50\% \), \( C_4H_6O_3 \), a thick brownish liquid which has recently been introduced as a substitute for tartar for mordanting wool.

Tannic acid. See tannin.

Arsenious acid. See arsenic compounds.

Ethyl tartrate, \( C_8H_{18}O_5 \), a thick colourless liquid used as a solvent in calico printing.
   It is only an incomplete substitute for our Acetine J.

Acetine J, see page 470.

2. Arsenic compounds.

Arsenic acid, \( As_2O_3 \), a white difficultly soluble powder.

   It is used in a few special cases for calico printing or for printing materials consisting of cotton and silk.
   Its use for this purpose is forbidden in several countries.
3. Antimony compounds.

The various antimony compounds used in dyeing and printing (tartar emetic, antimony salt, patent salt, antimony oxalate, antimonine, &c.) serve for fixing tannic acid on the fibre, as a resist for Acetine Blue, &c.

With regard to the composition and action of the chief members of this group, see page 166.

4. Tin compounds.

Tin crystals, stannous chloride, SnCl₂ + 2 H₂O, colourless crystals which dissolve in water to a dull solution.

It serves as a discharge for printing on cotton and wool. It is also added to the bath when dyeing cochineal and for brightening Turkey red.

Chloride of tin, stannic chloride, SnCl₄ + 3 H₂O, comes into commerce as white crystalline lumps which are readily soluble in water, and attract moisture from the air.

It is used as a mordant in cotton dyeing for producing bright blue shades. Large quantities of it are also consumed for weighting silk.

Pink salt, SnCl₄ + 2 (N H₄Cl), a double salt of stannic and ammonium chloride, occurs as colourless crystals, which attract moisture from the air.

This product also serves for weighting silk.

Sodium stannate, preparing salt, SnO₃Na₂ + 3 H₂O, a colourless crystalline mass, which disintegrates on exposure to air.

It is used as a mordant in cotton dyeing for producing bright blue and red shades. It also serves for weighting silk and for preparing wool for printing.
Oxalate of tin 25° Tw., Mordant OX, Sn(C₂O₄)₂, is placed on the market as a concentrated solution and is used for printing with Alizarine dyes.

Acetate of tin 34° Tw., Sn(CH₃COO)₂, a colourless solution which has recently been extensively adopted for discharge printing on cotton and on materials consisting of cotton and silk, as it does not attack the fibre so much as tin salt. It is prepared by dissolving stannous hydrate in acetic acid.

Stannous hydrate, Sn(OH)₂, is obtained as a white paste, which rapidly becomes brown in the air, by decomposing tin salt with soda.

This product is used for the same purposes as acetate of tin.

5. Potassium salts.

Potassium chlorate, KClO₃, colourless soluble crystals.

It is used as an addition to many printing pastes and also serves as an oxidizing agent for producing Aniline black.

Potassium bromate, KBrO₃. Used for discharging Alizarine colours.

Tartar, bitartrate of potash, C₄H₆O₇K, is generally met with as grey to yellowish grey crystalline crusts, as a powder or the so-called half crystals. It is difficultly soluble in water.

Tartar is used with bichromate of potash when mordanting wool with chrome.

Lactoline, potassium acid lactate, C₃H₅O₄K, is placed on the market as a thick 50°/₀ solution.

It is used as a substitute for tartar when mordanting wool with chrome.
Permanganate of potash, $\text{KMnO}_4$, dark red needle-shaped crystals with a blue metallic lustre.

It was formerly used in calico printing for producing a brown shade, but it is now, for this purpose, generally replaced by manganese chloride which is cheaper and easily soluble. This product can also be used as a bleaching agent for several of the textile fibres. (The goods are impregnated with $1/10$ to $1/4\%$ solution of permanganate in water, allowed to oxidise for $1/2$ hour in the air, then rinsed in water which contains sulphurous acid and washed.)

Potash, carbonate of potash, $\text{K}_2\text{CO}_3 + 2\text{H}_2\text{O}$, white crumbling deliquescent pieces or lumps.

It is added to the dye-bath with several substantive dyes but in most cases soda, which is cheaper, can be used instead.

Potassium sulphocyanide, $\text{KCN}_5$, is used with Aniline colours as a resist for Aniline black.

Potassium ferricyanide, $\text{K}_4\text{Fe}_6\text{Cy}_12$, brownish red crystals used in combination with chlorates for discharging Alizarine and Aniline colours on cotton.

In conjunction with alkalies it serves for discharging Indigo, &c.

Potassium ferrocyanide, $\text{K}_4\text{FeCy}_6 + 3\text{H}_2\text{O}$, yellow crystals used for producing Prussian Blue, as oxidising agent for Aniline black (Prudhomme's process) and as an iron mordant for Alizarine Colours in several cases in calico printing.
6. Sodium salts.

Caustic soda, NaOH, white strongly corrosive lumps, easily soluble in water.

It is also sold as a solution under the name of “soda-lye” which is frequently used for boiling out cotton. This product also serves as a discharge for several colours, as an addition to the indigo vat, as a solvent for Beta-Naphthol, as a reducing agent in conjunction with glucose, for mercerising cotton, &c.

The solutions which are placed on the market generally show 72—78 ° Tw. and contain 35% of solid caustic soda (NaOH).

Soda, calcined soda, sodium carbonate, Solvay soda, Na₂CO₃. It is a white powder which is easily soluble in water and is used for cleansing cotton, for scouring wool, &c.

Soda is added to the dye-bath with many substantive dyes and is also used for neutralising dye-liquors (for wool) which have become too acid, for neutralising alum, &c.

Crystal soda, soda crystals, Na₂CO₃·10H₂O. Colourless crystals which effloresce when exposed to air.

It is used for the same purposes as calcined soda but is considerably more expensive in use; 1 part of calcined soda has the same practical value as 2½ parts of crystal soda.

Borax, sodium borate, Na₂B₄O₇·10H₂O, a white soluble powder.

It is used as weak alkali when dyeing with Alkali Blue, and also in isolated cases in calico printing (for Indophor).

Sodium silicate, soluble glass, Na₂Si₄O₉, is supplied as a thick aqueous solution from 72—78 ° Tw.

It is used for fixing alumina and chrome mordants on silk, for partly neutralising sodium peroxide bleaching liquors, as a weak alkali when dyeing with Alkali Blue, &c. It is also employed in a few cases in calico printing.
Bicarbonate of soda, NaHCO₃, a white soluble powder used for fixing alumina and chrome mordants on silk.

Sodium peroxide, Na₂O₂, white lumps which must be carefully kept from contact with straw, wood, or paper on account of the danger of explosion.

Sodium peroxide is highly valued as a bleaching agent, but at present on account of its high price it is only used for silk, Tussah, fine qualities of wool, &c. See page 240.

Sodium sulphide, Na₂S + 9H₂O, a colourless or brownish crystalline mass which is very soluble in water and very corrosive.

It is used in dyeing with Fast Black, Anthraquinone Black, Kryogene colours, &c. on cotton.

Sodium bisulphate, see under sulphuric acid, page 447.

Glauber's salt, sulphate of soda, Na₂SO₄ + 10H₂O, small colourless crystals.

It is very extensively used as a levelling agent in wool dyeing and also for dyeing cotton with substantive dyes.

Calcined Glauber's salt is considerably cheaper but more difficult to dissolve, and it is therefore seldom used in the dye-house. 44 parts of calcined Glauber's salt have the same effect as 100 parts of the crystalline salt.

Sodium chlorate, NaClO₃, colourless soluble crystals. It is used for discharging Alizarine colours, as oxidising agent for Aniline black, and as an addition to several printing pastes for wool. It has the advantage of being easier to dissolve than the potassium salt.

Bisulphite of soda, NaHSO₃, is supplied as an aqueous solution at 72—78°F. We have recently commenced to deliver it in the solid state. It is used for producing hydrosulphite for the hydrosulphite vat, as an addition to the printing pastes for discharging on wool and silk, for preparing the rinsing bath in the permanganate bleaching process, and for rendering several Alizarine colours soluble, &c.
Hypochlorite of soda, Eau de Javelle, \( NaOCl \), is obtained by adding soda to a bleaching powder solution. It is a good substitute for the latter.

For this purpose a solution at \( 1\frac{1}{2}^0 \) Tw. is prepared by rubbing

\[ 2\frac{1}{4} \text{ lbs. bleaching powder} \]

in a suitable vessel with

\[ 4\frac{1}{2} \text{ pints water.} \]

Whilst constantly stirring

\[ 1\frac{1}{4} \text{ pints of soda solution (containing } 2\frac{1}{2} \text{ oz. calcined soda)} \]

are added. The solution is now diluted with \( 5\frac{1}{4} \) pints of water, well stirred and the precipitate is allowed to settle. The clear solution is now poured off and water is added until it shows \( 1\frac{1}{2}^0 \) Tw.

This solution serves for preparing wool with chlorine, for bleaching cotton (see pages 136 and 354), and also, but seldom, for bleaching shoddy.

Sodium acetate, \( C_3H_5O_2Na + 3H_2O \), colourless or slightly yellowish needle-shaped crystals. It is used when developing with Nitrosamine and is also added in a few cases to the printing pastes or tin crystals discharge pastes used in calico printing. It also serves as a resist for Aniline black (Prudhomme's process).

Sodium citrate, \( C_6H_5O_7Na_2 \), colourless crystals.

It is used in conjunction with potassium ferricyanide and chlorates in the oxidation discharge for Aniline black.

Common salt, \( NaCl \).

It is used when dyeing cotton with colours of the Eosine or Cotton Scarlet group, but more especially with the substantive dyes.

Nitrite, sodium nitrite, \( NaNO_2 \), small colourless, easily soluble crystals.

It is used in preparing the diazotising baths for developing colours on the fibre, see page 190 and following pages.
Antichlor, sodium thiosulphate, hyposulphite of soda, \( \text{Na}_2\text{S}_2\text{O}_3 + 5\text{H}_2\text{O} \), rather large colourless, easy soluble crystals.

As the name antichlor suggests it is used to render harmless the traces of chlorine which may be left in cotton after bleaching. It is generally added to the second rinsing bath through which the freshly bleached goods are passed.

Hydrosulphite, sodium hydrosulphite, \( \text{NaHSO}_3 \).

It is obtained as a very unstable solution by reducing sodium bisulphite with zinc dust whilst keeping the mixture cold. See process, page 480.

It is used in a few cases for stripping shoddy, but its chief application is for the hydrosulphite (indigo) vat.

Sodium hydrosulphite is also produced as a very concentrated solution and also as a solid double salt by processes which we have patented.

Turkey-red oil F and D. The first is a sulphaacid of ricinoleic acid, and the second is the sodium salt of ricinoleic acid, see under soaps, &c., page 469.

Sodium phosphate, \( \text{Na}_3\text{HPO}_4 + 12\text{H}_2\text{O} \), colourless, easily soluble crystals which crumble in the air.

It is used when dyeing or printing with sensitive substantive dyes in order to obtain the clearest possible shades. Large quantities of it are also used for weighting silk.

Sodium stannate, see tin compounds.
7. Ammonia and its salts.

Ammonia, caustic ammonia, liquor ammoniac (NH₄)OH, a strongly smelling corrosive liquid.

It is used for cleansing wool, for neutralising old dye-liquors which have become too acid and when producing several shades on unions by the one-bath process. Small quantities are also added to the Turkey-red oil liquors in order to clear them when mordanting.

Carbonate of ammonia, (NH₄)₂CO₃ + H₂O, colourless crystals which smell of ammonia and crumble in the air. Can be used for cleansing wool.

Acetate of ammonia, (NH₄)C₂H₃O₂, aqueous alkaline solution with an ammoniacal and empyreumatic smell. Used when dyeing woollen yarn and cloth to produce even dyeings and better penetration.

It was first recommended by us in 1888 for wool dyeing.

It is also highly valued for stripping shades which have come up too dark, as it does not damage the material.

Sal-ammoniac, ammonium chloride, NH₄Cl, easily soluble white crystalline powder, or white cakes.

It is used as a fixing agent when dyeing Alizarine Red on a mordant of aluminate of soda.

Ammonium sulphocyanide, NH₄CNS, colourless, easily soluble deliquescent crystals.

It is used to counteract the injurious action of bright copper boilers when dyeing with Aniline or Alizarine colours. (See page 92, note 3.) It is also added to tin crystals discharge pastes.

Ammonium vanadate. Used as an addition in several Aniline black processes.

Ammonium phosphate, (NH₄)₂H₂PO₄. This substance serves the same purpose as sodium phosphate when dyeing with certain substantive dyes and gives somewhat better results.
8. Lime and lime salts.

Caustic lime, quicklime, CaO, slaked with water gives slaked lime, Ca(OH)₂, with more water, milk of lime. It is used for preparing acetate of lime, also for adding to the dye-bath when dyeing Turkey-red if the water is soft. It is also used for the woad, vitriol, and zinc-lime vats.

Chalk, carbonate of lime, whitening, CaCO₃, is a white insoluble, very finely divided powder which is used when dyeing and printing Turkey-red with alizarine in order to fix the alumina (chalking). It is also added to the tartar emetic baths which are used in printing.

Acetate of lime, Ca(C₂H₃O₂)₉, is a white or greyish easily soluble mass.

It is used when printing Alizarine colours on cotton, wool, and silk, also when dyeing with Alizarine colours on alumina-mordanted wool or chrome-mordanted cotton. It is also added to the dye-bath when using Dark Green in paste.

Hypochlorite of lime, bleaching powder, Ca(ClO)₂ + CaCl₂, is a white powder which smells of chlorine.

It is used for bleaching cotton, for preparing wool with chlorine previous to printing with Aniline or Alizarine colours and also for imparting to wool a feel and glance like silk.

As a rule a solution of bleaching powder at 1 1/2 ° Tw. is used which is prepared by well rubbing together

\[ 2 \frac{3}{4} \text{ lbs. of bleaching powder} \]
\[ 4 \frac{1}{2} \text{ pints of water,} \]

To this is then added

\[ 5 \frac{1}{4} \text{ pints of water} \]

the mixture is well stirred and then allowed to settle. The clear solution is now poured off and water is added until it shows 1 1/2 ° Tw.

In many cases this solution of bleaching powder is replaced by one of hypochlorite of soda (see page 455).

Barium chloride, $\text{BaCl}_2 + 2\text{H}_2\text{O}$, colourless crystals used in conjunction with sulphuric acid for whitening many kinds of cloth.

Barium sulphocyanide, $\text{Ba}(\text{CNS})_2$, colourless soluble crystals used for preparing sulphocyanides of aluminium and chrome.

10. Magnesium salts.

Magnesium sulphate, Epsom salts, $\text{MgSO}_4 + 7\text{H}_2\text{O}$, colourless soluble crystals which are chiefly used for weighting wool. It is also used when bleaching silk with sodium peroxide.

Magnesium chloride, $\text{MgCl}_2 + 6\text{H}_2\text{O}$, a colourless crumbling crystalline mass, or crystals, used for weighting wool.

Magnesium carbonate, $\text{MgCO}_3$, a white powder used for discharging Alizarine colours on cotton cloth.

Magnesium acetate, $\text{Mg}(\text{C}_2\text{H}_3\text{O}_2)_2 + 4\text{H}_2\text{O}$, a powdery mass which smells of acetic acid. It is used in calico printing, especially when working with colours of the Eosine group.
11. Zinc compounds.

Bisulphite of zinc 32° Tw., Zn (HSO₃)₂, a yellowish clear liquid used when printing calico with Alizarine Blue.

Zinc chloride, Zn Cl₂, a white easily soluble, deliquescent mass, considerable quantities of which are used when sizing and finishing cotton.

Zinc sulphate, white vitriol, Zn SO₄ + 7 H₂O, colourless, easily soluble crystals. It serves for weighting cotton and is also added to the tartar emetic resist in calico printing.

Zinc nitrate, Zn (NO₃)₂ + 6 H₂O, a colourless, deliquescent salt used in isolated cases in printing.

Zinc dust, a grey, very heavy insoluble powder which is a mixture of metallic zinc and zinc oxide. It is used in the zinc vat, for producing hydrosulphite for the hydrosulphite vat, and also as a splendid discharging agent for printing.

12. Copper compounds.

Copper sulphate, bluestone, blue vitriol, CuSO₄ + 5 H₂O, blue soluble crystals.

Its chief application is for Aniline black dyeing. It has recently become of considerable importance in the after-treatment of wool or cotton, dyed with many of the substantive dyes, in order to make the dyeings faster.

In this manner shades which have been produced with certain colours on wool are made faster to steaming. Copper vitriol is also used in several processes when dyeing with logwood and Aniline colours in one bath.
Copper sulphide, CuS. This is used in the form of a black paste for printing with Aniline Black. It is also produced on the fibre in several Aniline Black dyeing processes.

Copper acetate, Cu(C₂H₃O₂)OH + 2¹/₂H₂O, is placed on the market in the form of blue scales or needles. It is used as a resist for Indigo blue.

13. Lead compounds.

Acetate of lead, sugar of lead, Pb(C₂H₃O₂)₂ + 3H₂O, colourless soluble crystals. (Pyrolignite of lead prepared from crude acetic or pyroligneous acid is a yellowish brown mass with a burnt smell.)

Sugar of lead is only used in the dye-house for producing chrome yellow and chrome orange but it also serves for producing various mordants (e.g., acetate of alumina, &c.).

Sulphate of lead, PbSO₄, an insoluble white powder. It plays an important part in the manufacture of indigo-dyed goods for producing a beautiful white and also for a yellow by afterwards passing the goods through a solution of bi-chromate of potash.

14. Alumina compounds.

Acetate of alumina is prepared from sulphate of alumina and sugar of lead, or by dissolving hydrate of alumina in acetic acid.

An aqueous solution of the normal acetate decomposes on standing. For this reason it is generally replaced in the dye-house by

Sulphate acetate of alumina

which is also prepared by acting on sulphate of alumina with sugar of lead. According to the quantity of sugar of lead used an alumina compound is
obtained in which more or less of the sulphuric acid of the sulphate of alumina is replaced by acetic acid.

The compound

\[ \text{Al}_2(\text{SO}_4)_2(C_2\text{H}_3\text{O}_2)_2 \]

in which one molecule of sulphuric acid has been replaced by 2 of acetic acid is produced from

1 lb. 4 » » sulphate of alumina.

The compound

\[ \text{Al}_2(\text{SO}_4)(C_2\text{H}_3\text{O}_2)_4 \]

is produced from

13½ oz. of sugar of lead
10 » » sulphate of alumina,
two molecules of sulphuric acid being replaced by 4 of acetic acid.

These compounds can of course also be produced by dissolving hydrate of alumina in corresponding amounts of acetic and sulphuric acids.

A method which has recently been extensively used is to dissolve double carbonate and aluminate of alkali in acetic acid or in a mixture of this and sulphuric acid.

The following is a good recipe for producing sulphate acetate of alumina from sugar of lead:—

Dissolve

15¾ lbs. sugar of lead in
12½ pints of boiling water and
17½ lbs. sulphate of alumina

(free from iron and containing 12 molecules of water of crystallisation and 18% \( \text{Al}_2\text{O}_3 \)) in
12½ pints of boiling water.

These two hot solutions are mixed together and the clear solution is poured off from the white precipitate. The latter, which consists of lead sulphate, is washed in water and the wash water is used for diluting the acetate of alumina to 15° Tw. or 9° Tw. If the solution is not quite clear it must be filtered.

It is used instead of antimony salt for fixing tannic acid in cotton dyeing when special colour effects are required. It is also used in conjunction with Turkey-red oil as a mordant for Alizarine colours and in calico printing for fixing colours of the Eosine group, &c.
Sulphate of alumina, $\text{Al}_2(\text{SO}_4)_3 + 12\text{H}_2\text{O}$, a white crystalline, soluble mass. The commercial sulphate of alumina contains 12 molecules of water of crystallisation, i.e., it contains $38 \%$ of water and $18 \% \text{Al}_2\text{O}_3$. It should be free from iron.

It serves for producing acetate of alumina, as a mordant for Turkey-red oil, as a levelling agent and fixing agent for many of the Aniline colours used in cotton dyeing, also for producing hydrate of alumina for lakes.

Alum, potash alum, $\text{Al}_2(\text{SO}_4)_3\text{K}_2 + 24\text{H}_2\text{O}$, colourless crystals or white powder. It is now extensively replaced for dyeing purposes by the cheaper sulphate of alumina which for several years past has been placed on the market free from iron.

1 part of sulphate of alumina has the same practical value as 2 parts of alum.

Chloride of alumina, $\text{Al}_2\text{Cl}_6$, soft yellow grains. An aqueous solution of this salt is used for carbonising woollen cloths which have been dyed with colours that are sensitive to acids.

Aluminium sulphocyanide 32° Tw., $\text{Al}_2(\text{CNS})_6$, is used in the form of an aqueous solution as a mordant for printing Alizarine Red, &c. on cotton, wool, and silk.

This mordant is prepared by dissolving

6 lbs. 9½ oz. of commercial sulphate of alumina

(containing 18% Al₂O₃) in

4½ pints of water at about 140° F. and

9 lbs. 1½ oz. of barium sulphocyanide in

4½ pints of water at 140° F.

These two solutions are mixed together, the clear liquid is poured off from the white precipitate of barium sulphate, filtered if necessary and diluted to 32° Tw.

Aluminate of soda, $\text{Al}_2\text{Na}_2\text{O}_4$, a white soluble, crystalline mass used for mordanting cotton which is to be dyed Turkey-red.

Double carbonate of alkali and alumina. White lumps used for producing acetate or sulphate acetate of alumina.

Chlorate of aluminium, a thick liquid used in place of sodium chlorate for discharging in calico printing.
Mordants and Chemicals used in Dyeing, Printing, &c.

Hydrate of alumina, $\text{Al}_2(\text{OH})_6$, a white transparent paste.

It is obtained by reacting upon salts of alumina (sulphate of alumina, alum) with soda. It is used in a few cases in calico printing.

15. Chrome compounds.

Chrome alum, $\text{Cr}_2(\text{SO}_4)_3 \cdot \text{K}_2(\text{SO}_4) + 2\text{H}_2\text{O}$, large violet, easily soluble crystals. It is used for producing other chrome mordants and serves as a fixing agent in a few cases in wool dyeing.

Potassium bichromate, $\text{K}_2\text{Cr}_2\text{O}_7$, yellowish red crystals, easily soluble in water. It is very extensively used for mordanting wool for the Alizarine and a few of the Aniline dyes.

It also serves for stripping shoddy, for producing chrome yellow on the fibre, for after-chroming dyeings produced with a number of substantive and acid dyes, as an oxidising agent for producing Aniline black and as a discharge for Indigo, &c.

Sodium bichromate, $\text{Na}_2\text{Cr}_2\text{O}_7 + 2\text{H}_2\text{O}$, a yellowish red deliquescent crystalline mass, which serves the same purpose as potassium bichromate but is cheaper and has the same practical effect.

Fluoride of chrome, $\text{F}_6\text{Cr}_2$, a green soluble powder used as a mordant for dyeing Alizarine colours on wool. It also serves for after-chroming dyeings on wool.

Chromium acetate is placed on the market as a basic salt possessing the formula $\text{Cr}_2(\text{OH})_2(\text{C}_2\text{H}_3\text{O}_2)_4$, under the name of

Acetate of chrome $32^0$ Tw.

also as

Solid acetate of chrome

and as a neutral salt whose formula is $\text{Cr}_2(\text{C}_2\text{H}_3\text{O}_2)_6$, viz.,

Green acetate of chrome $40^0$ Tw.
It is used as a mordant for printing with Alizarine and a few Aniline colours (for shades with Eosines which are fast to washing) and also to a limited extent for cotton, wool, and silk dyeing.

Chloride of chrome, $32^0$ Tw. and $52^0$ Tw., $\text{Cr}_2\text{Cl}_2(\text{OH})_4$ is a basic chloride of chrome which is used in the form of a green solution as a mordant when dyeing with Alizarine colours on cotton and silk.

Bisulphite of chrome, $48^0$ Tw. and $34^0$ Tw., is a green solution used for dyeing with Alizarine colours and also for calico printing.

Sulphocyanide of chrome $32^0$ Tw., $\text{Cr}_2(\text{CNS})_6$, is a green solution, small quantities of which are used when printing with Alizarine colours on silk.

16. Manganese compounds.

Permanganate of potash, see under potassium salts.

17. Iron compounds.

Acetate of iron, $\text{Fe(C}_2\text{H}_3\text{O}_2)_2$, pyroline of iron, a dark liquid with a burnt smell, generally placed on the market with a concentration of $23^0$ Tw. (also $32^0$ and $52^0$ Tw.).

It serves as a mordant when dyeing and printing with Alizarine colours and is also used in conjunction with tannic acid for producing blacks in cotton and union dyeing (see page 289 and following pages).

It is also used for dyeing and printing with Dark Green in paste.
Nitrate of iron was formerly prepared by treating green vitriol with nitric acid, hence the incorrect name "nitrate of iron"; it is really a basic sulphate of iron. It is used in considerable quantities for silk dyeing, and besides it serves the same purposes as pyrolignite of iron but is for many purposes more suitable than the latter.

Nitrate of iron is generally sold at a concentration of 91\% Tw.

Chloride of iron, Fe₂Cl₆, ferric chloride, yellow crystalline lumps, or a brown solution.

Ferrous sulphate, FeSO₄ + 7 H₂O, green vitriol, bluish green soluble crystals, the outside of which is brownish due to decomposition and oxidation.

It is added to the bath when dyeing wool with logwood and Aniline colours.

It also serves for fixing tannic acid for cotton dyeing and as a reducing agent when setting the so-called vitriol vat.

Potassium ferrocyanide, see under potassium salts, page 452.

Potassium ferricyanide, see under potassium salts, page 452.

18. Nickel compounds.

Nickel sulphate, NiSO₄ + 7 H₂O, green soluble crystals used for producing acetate of nickel.

Acetate of nickel, Ni(C₆H₁₂O₂)₂, green crystals. A solution at 15\% Tw. is used for printing Alizarine Blue on cotton.

Gum arabic is very soluble in water and is used as a thickening agent in calico printing—especially for light shades—and also for printing silk.

It gives very even prints and is very easy to wash out.

Wheat starch, used for printing medium and dark shades on cotton, wool, and silk. Large quantities are also used for finishes.

British gum serves as a thickening agent especially for printing wool and slubbing.

Dextrine, an easily soluble powder which serves as a thickening agent. Large quantities of it are used for preparing a cheap finish for cotton and woollen piece-goods.

Wheat flour is specially adapted for printing linen cloth, it also serves for printing carpet yarn.

Dark burnt starch and

Light burnt starch are used for special purposes in calico printing.

Gum tragacanth is used in conjunction with starch for calico printing. It is also a valuable finishing agent.

Leiogomme, roasted potato starch, is used for printing either alone or in conjunction with other thickening agents.

Potato starch is chiefly used as a finish.

Albumen is used in calico printing as a fixing agent for insoluble colours, &c.

Glue is a valuable finishing agent.

Gelatine is also used to a certain extent as a finish.

Caseine is used for the same purposes as albumen.
20. Tannin materials.

Tannic acid, tannin, a light brownish, easily soluble powder.

Sumach leaves, yellowish leaves possessing a strong smell (powdered sumach is not so reliable).

Sumach extract, a thick brown liquid which generally stands at $52^\circ$ Tw. It is also sold as a solid.

Liquid extracts are very liable to ferment on standing and this is a great disadvantage.

Myrabolans, hard nuts, which are easier to extract if previously ground.

Gall-nuts, are hard round excrescences on plants. They are found on the leaves of certain species of oak trees and are caused by the sting of an insect. Before use they are ground to a coarse powder.

Divi-divi, hard nuts similar to myrabolans.

Quebracho, a kind of Brazil wood.

The various tannins just mentioned are fixed with antimony compounds, iron salts, &c., and serve as mordants in cotton dyeing, printing, &c.

Tannic acid is also used in silk printing to render shades produced with basic colours faster to washing.

Details regarding the comparative value of the various tannins, their properties, &c., are to be found on page 167.
21. Soaps, oils, &c.

Soap (soda soap, olive oil soap, Marseilles soap), is easily soluble in water with which it forms a froth.

It is extensively used for milling, washing, and cleansing of dyed and undyed material.

The soap should be neutral, i.e., it should contain no excess of alkali and it should also be free from unsaponified fat which is insoluble in water.

Soft soap, potash soap, acts more energetically than soda soap and is used in a few cases in the woollen industry.

"Boiled-off" liquor is a solution of silk gum in the soap used for boiling off the silk. It is added to the bath when dyeing silk.

Olive oil is added to the thickenings which are used for printing with Aniline or Alizarine colours, and also for preparing cotton for the old Turkey-red process. It also serves for softening cotton which has become too hard during dyeing.

Tournant oil is olive oil which has become rancid. It is used in the old Turkey-red process.

Castor oil, used for making Turkey-red oil and also for rendering thickenings softer and smoother.

Turkey-red oil, a more or less clear, thick liquid which gives a slightly cloudy solution in water. The various kinds of Turkey-red oil are generally produced by the action of sulphuric acid or caustic soda on castor oil; olive or other oils being seldom used for this purpose.

When castor oil is treated with sulphuric acid, glycerine and the sulphuric ether of ricinoleic acid are produced (Turkey-red oil F). This is used for preparing the cotton in the new Turkey-red process and when dyeing with Alizarine colours on a chrome mordant. It also serves for mordanting cotton which has to be dyed very bright shades with Rhodamine and for adding to the liquors when dyeing Nitrosamine Red.
Mordants and Chemicals used in Dyeing, Printing, &c.

The product obtained by saponifying castor oil with caustic soda (Turkey-red oil D) is the sodium salt of ricinoleic acid and serves for preparing cloth which has to be printed with Alizarine colours.

Alcohol, spirits of wine serves as a solvent for spirit colours.

Glycerine, a thick yellowish liquid used for printing wool and for preparing alkaline chrome mordant.

Acetine J is a thick perfectly clear liquid which is extensively used in calico printing and is highly valued as an excellent solvent for spirit and basic dyes.
Appendix.
Notes on Weights and Measures, Specific Gravity, and Temperatures.

In this book the specific gravity has been expressed by degrees Twaddell and the temperature by Fahrenheit.

The following comparative tables shewing the relation to some other systems will in many cases prove interesting and useful.

I. Measures.

a) Measures of length.

Metrical system.

1 metre = 10 decimetres = 100 centimetres = 1000 millimetres.

English measure.

1 yard = 3 feet = 0.9144 metres.

Russian measure.

1 arsin = 0.7112 metres.

b) Superficial measures.

Metrical system.

1 square metre = 100 square decimetres = 10,000 square centimetres = 1,000,000 square millimetres.

English measure.

1 square yard = 9 square feet = 0.836 square metres.
c) Measures of capacity.

**Metrical system.**

1 cubic metre = 1,000 cubic decimetres ( = 1,000 litres)
1 cubic decimetre = 1 litre = 1,000 cubic centimetres.

**English measure.**

1 cubic yard = 27 cubic feet = 0.7645 cubic metres
1 gallon = 2 pottles = 4 quarts = 8 pints = 32 gills = 4.5436 litres.

A gallon of water weighs ten pounds.

II. Weights.

**Metrical system.**

1 kilogramme (kilo) = 10 hectogrammes (hg.) = 100 decagrammes (dg.)
= 1,000 grammes (gr.)
1 1/2 = 1/2 kilo.

**English weights.**

1 pound (lb.) = 16 ounces (oz.) = 453.6 grammes
1 hundredweight (cwt.) = 112 lbs. = 50.8 kilos
1 ton = 20 cwts.

**Russian weights.**

1 pound = 96 solotnik = 409.5 grammes
1 pud = 40 pounds = 16.38 kilos.
### III. Specific gravity.

Comparison of degrees Twaddell with degrees Beaumé.

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Notes on Weights and Measures, Specific Gravity, and Temperatures.

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Comparison of the strength of various assistants.

As many dyers are uncertain with regard to the relative practical value of several acids and salts which are placed on the market in various forms or concentration we give some information on the subject here.

Value of crystal soda as compared with calcined soda (ammonia soda).

100 parts by weight of crystal soda have the same practical value as about 37 parts of calcined soda.

100 parts of calcined soda can be replaced by 270 parts crystal soda.

Value of crystallised Glauber's salt as compared with calcined
Glauber's salt.

100 parts by weight of crystallised Glauber's salt correspond to 44 parts by weight of calcined Glauber's salt.

100 parts by weight of calcined Glauber's salt can be replaced by about 227 parts by weight of crystallised Glauber's salt.

Value of alum as compared with sulphate of alumina.

This comparison relates only to the practical value of these substances in dyeing.

In this sense 100 parts of alum (potash alum containing 10.76% $\text{Al}_2\text{O}_3$) produce the same effect as 60 parts of sulphate of alumina (18% $\text{Al}_2\text{O}_3$).

On the other hand 100 parts of sulphate of alumina produce the same effect as 170 parts of alum.
Comparison of ordinary hydrochloric acid (commercial at 32° Tw.), ordinary sulphuric acid (commercial containing 93—94%o), and acetic acid (commercial at 9° Tw.).

In this case also the chemical action of these totally different acids is left entirely out of consideration and we simply compare their power of decomposing salts of other acids, e. g., sodium nitrite, soda, carbonate of lime, &c.

100 parts of sulphuric acid 168° Tw. correspond to 220 parts hydrochloric acid 32° Tw. or about 400 parts acetic acid 9° Tw.

100 parts of hydrochloric acid 32° Tw. correspond to about 45 1/4—45 1/2 parts sulphuric acid 168° Tw. or about 175 parts acetic acid 9° Tw.

100 parts acetic acid 9° Tw. correspond to about 25 3/4 parts sulphuric acid 168° Tw. or about 57 parts hydrochloric acid 32° Tw.
Preparation of sodium hydrosulphite 20° Tw.

Mix

8 gallons = 108 lbs. of bisulphite 72—76° Tw. with
19 » of water at the ordinary temperature (60—65° F.).

In 1/4 hour stir into this

7 lbs. zinc dust made to a paste with 1 gallon of water.

Under normal conditions the temperature rises to about 95° F.

Stir for some time cautiously, i.e., without introducing much air and then allow to stand.

After 1 hour (or even a longer time), draw off the clear solution into milk of lime which has been prepared by cautiously slaking 9 lbs. good burnt lime in 2 gallons of water.

It is of no importance if the solution looks a little dull.

The mixture with lime is stirred slowly but continuously, for some time and then allowed to settle for several hours or even overnight. After drawing off the clear solution, it is stored in stoppered glass carboys.

The yield according to this method is about 14—15 gallons of hydrosulphite 20° Tw.

Notes.

a) When preparing hydrosulphite all unnecessary violent stirring, decanting, or moving of the liquid should be avoided.

b) As hydrosulphite is very easily decomposed it is not advisable to prepare more than is to be used up in 3—4 days.

c) A little caustic soda can be added to the hydrosulphite solution which ensures better preservation (about 1 gill caustic soda 76° Tw. per 6 gallons of hydrosulphite).
Table showing the amounts of nitrite, &c., required when diazotising substantive dyes on the fibre.

The following figures are not supposed to be in exact chemical proportion, as the dyestuffs and developers in question are chemically different and therefore do not all react in the same proportion.

For practical reasons the figures given below are so chosen that a sufficient excess of developer is prescribed.

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<tr>
<th>Dyestuff</th>
<th>Sodium nitrite</th>
<th>Sulphuric acid 168°Tw.</th>
<th>Or hydro-chloric acid in place of sulphuric acid</th>
<th>Developer</th>
<th>Notes</th>
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The quantities mentioned here only give good results when the proportion of goods to water is 1:15.
Special process for dyeing cotton yarn with Indoine Blue.

Enter the freshly boiled off yarn into the boiling sumach bath, give 6 turns and steep overnight. Next morning, wring, shake well, enter a cold antimony salt bath and give 8—10 turns. Rinse well, wring, and shake. Fill the dye-vat with the necessary quantity of cold water, add sulphate of alumina in the proportions stated below, enter the goods, give several turns, take out goods and add about 1/8 of the colour solution through a fine sieve. After giving 6 turns add another 1/8 of the colour then—continuing as before—add 1/4 and ultimately the remainder of the colour.

Now give further 6 turns, heat to 105° F., then to 160° F. Each time before raising the temperature take out the goods; on re-entering them when the higher temperature has been reached give them another 6 turns. Afterwards raise to the boil, keep the bath as near the boiling point as possible for 1/2 hour, and then work at intervals for 1/4—1/2 an hour whilst allowing the bath to cool.

Rinse once or twice in cold or lukewarm water, hydro-extract, and dry.

The bath ought to be quite exhausted.

The whole dyeing process (including the antimony salt passage and rinsing) occupies from 2 1/2—3 hours.

**Dissolving of the colour.**

Pour 13—18 gallons boiling water over the dyestuff required and stir well for a few minutes; the colour dissolves easily and completely. The solution is added to the dye-bath through a fine metal sieve.

**Proportions of colour for 100 lbs. cotton yarn.**

Light Blue:—About 4 1/2—6 1/2 lbs. Indoine Blue in paste with addition of sulphate of alumina on a mordant of sumach leaves and antimony salt.

Full Medium Blue:—About 9—11 lbs. Indoine Blue in paste dyed similarly.

Dark Blue:—About 17 1/2—24 lbs. Indoine Blue in paste dyed similarly.
Remarks.

1. A stronger mordant than indicated does not materially increase the fastness of the colour, renders the shade, however, somewhat greener.

2. Instead of antimony salt the same quantity of tartar emetic can be used; the latter, however, is dearer and does not benefit the colour in any way. The same holds good as regards a substitution of sumach leaves by sumach extracts or tannic acid.

3. For cheap and dull blues the antimony salt bath may be replaced by one of pyrolignite of iron. According to the depth of shade, use 2—6 pints pyrolignite of iron 23° Tw. per 100 gallons of water, otherwise working exactly as above described.

   The shades so produced, however, possess the advantage of those dyed on sumach-antimony mordant—retention of their beautiful blue shade in spite of repeated washing in hot soap and soda—to a far less degree. Sooner or later the grey bottom comes up and dulls the shade of the Indoine Blue. Such blues are therefore to be looked upon as good substitutes for less fast Aniline Colours or logwood rather than for indigo.

4. The quantities of sulphate of alumina stated in our process may be replaced by double the quantity of alum. Both products retard the going on of the colour and conduce to evenness and penetration. Comparatively more sulphate of alumina is used for light shades than for dark ones.

   If these products are added in too large quantities the bath is but imperfectly exhausted; the shades are of a more greenish cast but not quite so full in appearance.

5. There are some inferior descriptions of cotton yarn which even when dyed with the most level-dyeing of colours give trouble in regard to evenness. In such cases it is well after "boiling-off" the cotton to pass it through 1—2 lbs. hydrochloric acid 32° Tw. (about 30%o) per 100 gallons water and afterwards rinse. Then mordant according to the directions and dye.
6. In working with Indoine Blue it is advisable to use the hardest water obtainable as heavier shades are then produced and a saving of dyestuff is effected. If hard water is not to be had, then soft water may be used and without any detriment whatever to the colour,—or the water could be improved to a certain extent by the addition of gypsum solution or acetate of lime. (On no account must lime-water be used.)

7. If Indoine Blue is not dyed hot enough, redder and therefore apparently fuller shades are obtained. Although these blues are themselves very fairly fast, they are appreciably inferior to those dyed at the finish at the boiling point.

8. If the dyed goods are put through a lukewarm bath containing 1—2 lbs. sumach leaves per 100 gallons water (the first mordanting bath may be used if properly diluted) greener shades are obtained. The colours appear somewhat less full but are again still faster. (This treatment with sumach is also a means of correcting blues that have come up too reddish and full.)

9. Indoine Blue may be dyed together in one bath with Methylene Blue, Marine Blue, Methyl Violet, Saffranine, Diamond Green and similar basic colours.

To give the blue a redder cast, a good colour to shade with is Methyl Violet RRR. If when using rather large quantities of the last mentioned dyestuff, difficulty is encountered with regard to even-dyeing, this can be overcome by topping the Indoine Blue bottom with Methyl Violet in a fresh bath.

10. Indoine Blue may be topped with Indigo without the observance of any special precaution. As Indoise Blue stands acid well it may be subjected to the after-treatment with acid usual with indigo-dyed yarns. It is preferable, however, to reverse this process, a faster blue being obtained when the yarn is first bottomed with Indigo, well rinsed, mordanted with sumach and antimony salt, and then topped with Indoine Blue. In this case 1 quart acetic acid 9° Tw. is added to every 100 gallons of the sumach mordanting bath.

If the main object is to have a fast bottom of blue, and the greatest attainable fastness of the colour used for topping is not required, then indigo-bottomed goods may be topped with Indoine Blue direct, i.e., without mordanting.
To obtain a heavy dark blue about $13^{1}/4-15^{1}/2$ lbs. Indoine Blue in paste per 100 lbs. light blue indigo-dyed yarn are required. In this case the dyestuff-solution is added to the bath all at once. Further add $1^{1}/2$ lbs. sulphate of alumina per 100 gallons of water, enter the indigo-dyed yarn (which has previously been soured) lukewarm, heat to boil — working the yarn well all the time — and boil for $3/4$ hour. The bath is not quite exhausted and after being duly replenished may be used again.

The shades thus obtained are always somewhat redder than those dyed on a mordant. They are also inferior to the latter in fastness to washing, but far superior to colours dyed, for instance, with substantive blue, as they are not nearly so apt to stain interwoven white cotton in the wash.

11. For some time, a process has in some places found favour which consists in bottoming the yarn with substantive blue and then topping with Indoine Blue direct.

This process is not, however, generally speaking, one to be recommended, as the use of the substantive blue always causes any white cotton present to be more or less tinged with blue in the wash. Further the Indoine Blue itself is not so well fixed as is the case when a sumach-antimony mordant is used.

If for the sake of simplicity and economy the process in question should be adopted work as follows: — For 100 lbs. yarn bottom at the boil for $1/2-3/4$ hour with about 14—18 oz. Oxamine Blue B G or Phenamine Blue B, $5-5^{1}/2$ lbs. calcined Glauber's salt (or the same quantity of common salt), 14—18 oz. calcined soda, afterwards rinse.

Top in a fresh cold bath containing $7^{3}/4-18$ lbs. Indoine Blue BB or BBN in paste in addition to the sulphate of alumina; raise to the boil and boil for $1/2$ hour.

For light shades (for instance $7^{3}/4$ lbs. Indoine Blue in paste) the amount of sulphate of alumina required is about 1 lb. per 100 gallons dye-liquor. For dark shades (for instance 18 lbs. Indoine Blue in paste) only about $1^{1}/2$ lb. sulphate of alumina per 100 gallons is used, so that the bath may be adequately exhausted. Instead of sulphate of alumina double the quantity of alum may be taken.

When dyeing dark shades the bath is not exhausted, and may, if duly replenished, be used again.
Lastly it should be remarked that the absorption of Indoise Blue is not dependent upon the substantive bottom; the Indoise Blue can also be dyed direct on unmordanted yarn. (See method 3, page 158.)

Still better results can be obtained if the yarn which has been dyed a weak ground with substantive dyes is mordanted in the ordinary way with sumach and antimony salt and then dyed with Indoise Blue.

Notes.

a) 8 lbs. of Indoise Blue BB, BBN, R in paste correspond in strength with 1 lb. of the respective powder brands of Indoise Blue. (The brand Indoise Blue BR is only placed on the market in the form of a powder and it has the same strength as the other powder brands.)

b) For the comparison of sumach leaves and sumach extract with other tannin materials, see page 167.)

For a practical example of the dyeing of Indoise Blue on piece-goods, see page 206.
Table showing the proportion of Indoine Blue to mordant and sulphate of alumina, &c.

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Nitrosamine Red on Cotton Yarn.

Calculated for 50 lbs. yarn (raw weight).

Boiling-off the Yarn.

Before bottoming with Beta-Naphthol, carefully boil-off the yarn in an open wooden vat or in the boiling-off machine with the addition of 2% calcined soda, adding also, if necessary, a little silicate of soda or Turkey-red oil (1/4% of the weight of the goods); rinse, hydro-extract, and dry.

Preparation with Beta-Naphthol.

Prepare the following mordanting liquor:—

1 lb. 8 oz. of Beta-Naphthol, ground
1 » 8 » » soda lye 72—76° Tw.
5 lbs. 4 » » Turkey-red oil F 50% 

filling up with water to 7 1/2 gallons in all.

If a somewhat heavier, more bluish shade is required, or if difficulty is experienced, in dyeing even shades it is advisable to prepare the mordanting liquor as follows:—

1 lb. 14 oz. of Beta-Naphthol
1 » 14 » » soda lye
5 lbs. 4 » » Turkey-red oil F 50% 

likewise brought up to 7 1/2 gallons.

Turkey-red oil F is the soda salt of the sulphonic acid of ricinoleic acid. It cannot be replaced by the ammonia salt, nor clarified with ammonia. A reduction in the quantity of Turkey-red oil stated brings about considerably yellower shades.

Prepare this mordanting liquor by pouring the soda lye on the finely ground Beta-Naphthol in an enamelled or wooden vessel, then adding 1 3/4—2 gallons hot water. After a little stirring, a clear solution will have resulted without any difficulty.

Now stir in the Turkey-red oil and fill up with water until the whole measures 7 1/2 gallons. It is expedient to use the liquor warm, as it then penetrates better into the yarn.
Nitrosoamine Red on Cotton Yarn.

It should be prepared for one day's use at the most, as it commences to decompose in about 10 hours' time.

To saturate the yarn, use as first bath about

3 1/4 gallons of the Naphthol solution

in a wooden vessel, such as is often used for mordanting for Turkey-red, or failing this, in a deep enamelled or earthenware basin; take a handful of yarn (= 2 lbs.) on a rod, and give 4 or 5 turns. Then wring slightly (twice), and lay the yarn aside on a clean and thoroughly dry horse.

Now add to the bath 1/6 gallon standard mordanting liquor, take a second handful of yarn, proceed in the same way, and lay it aside next to the first lot.

Add further 1/6 gallon standard naphthol solution, take a third handful of yarn, and so on until the whole lot has been gone through.

By adhering to the quantities stated, and wringing the successive handfuls of yarn fairly carefully over the bath, so that the liquor wrung out runs back into the bath, the latter always keeps at about the same level.

If the various additions of mordanting liquor be correctly measured out, the last handful of yarn ought to coincide with the addition of the rest of the liquor.

If the separate additions were measured to a nicety, about 2 pints mordanting liquor would remain. We have, however, made this allowance for probable losses in working.

Now repeat the entire process above-described, taking the hanks, in the succession in which they were finished the first time, again through the old impregnating liquor. This time no additions of fresh naphthol solution are made.

Incomplete or too short impregnation with Beta-Naphthol causes yellower shades and the appearance of lighter streaks and spots.

Give each handful a few turns, wring slightly (twice), hydro-extract, and stretch the hank with the hands before hanging it up.

The hydro-extractors should be lined either with cloth or wicker-work. The yarn must not be brought into contact with metal, especially not with copper.

Incomplete wringing or hydro-extracting can result in brownish streaks, caused by the surplus liquor, in drying, settling on the outside, or towards the bottom of the hanks.

Should it be preferred to avoid hydro-extracting, and simply to wring, the yarn must be wrung thrice. Then straighten out and shake the yarn. We expressly mention, however, that faulty results are, oftener than not, ascribable to bad—either excessive or insufficient—wringing. Broadly speaking, we dissuade people from adopting the latter method, although, on the other hand, it must be admitted that there are dyers, especially among Turkey-red dyers, who obtain as good results by wringing, as by using the hydro-extractor.
Nitrosamine Red on Cotton Yarn.

We mention particularly that the whole process of impregnating with Beta-Naphthol should be carried out with extreme care, as the production of even and beautifully bluish shades chiefly depends upon this.

At the same time, care should be taken, that the quantity of solution retained by the yarn is always as uniformly the same as possible; it is well, until the necessary practise and dexterity has been acquired, to check this by weighing.

The proportionate weights, if well-bleached yarn is used, should be approximately as follows:—50 lbs. cotton yarn (raw weight) weigh when bleached and hydro-extracted, about 76—79 lbs.; this is equivalent to a dry weight of the bleached yarn of about 44 lbs.

Properly impregnated with Beta-Naphthol, the same quantity should weigh, hydro-extracted damp: about 81—88 lbs., dry: about 48½ lbs. From 1 lb. of raw yarn about 1 lb. 10 oz. impregnated and damp yarn, or about 1 lb. impregnated and dry yarn should therefore be obtained.

Drying the Yarn.

Dry the prepared yarn with all despatch (in about 3 hours). The best temperature is about 140° F., not above and not much below. It is advantageous to dry the naphthol-prepared yarns in a chamber by themselves, separated from other goods. Protect the yarn as much as possible from draught, damp, acid or chlorine fumes, also from the action of direct light.

It is absolutely essential to lead away the damp air.

Reverse the way the yarns are hung up several times during the drying process, not, however, touching them with the hands, especially when the fingers are damp, but by revolving the drying rods themselves.

It is hardly necessary to remark that the looser the hanks are hung up, the better will be the results.

If, in drying, the temperature stated, or other precautions are not observed, or, if owing to bad ventilation, the drying takes up too much time, the yarn become brownish and a bright red is not obtained.

If, after drying, the yarn appears at all streaky, it must be on account of mistakes in the preparation, or in wringing. In some cases a poor quality of Turkey-red oil may be the cause.

Streaky mordanted yarn produces, of course, a streaky red.

If at all possible, the further treatment of the yarn should be proceeded with immediately they are dry. If from any cause this is not practicable, the yarn must be protected from acid fumes, light, and moisture, a closed wooden case being best adapted for the purpose.
Developing with Nitrosamine Red.

For the above quantity of yarn prepare a developing bath as follows:—

6 lbs. 12 oz. Patent Nitrosamine Red in paste
2 > 8 > hydrochloric acid 32 ° Tw. (about 30 %)
2 > 4 > acetate of soda crystallised

and so much water that the whole measures 7 1/2 gallons.

If the stronger Beta-Naphthol solution (1 lb. 14 oz. — see page 488) has been selected, the Nitrosamine developing bath must also be made stronger.

Use:—

8 lbs. 2 oz. Patent Nitrosamine Red in paste
3 > hydrochloric acid 32 ° Tw. (about 30 %)
2 > 12 > acetate of soda crystallised

and bring up to 7 1/2 gallons.

Proceed in every case as follows:—Before weighing out the Nitrosamine Red paste, stir it up thoroughly, take out the required quantity, stir it up with fully 3 gallons cold water 64 ° F. (not higher) in a wooden vessel, and add the above-mentioned quantity of hydrochloric acid in thin jets, stirring slowly.

Now stir a few times, causing as little froth as possible, let stand for 25 — 30 minutes. The light yellow precipitate first formed will then, for the greater part, have disappeared; what remains will collect on the surface in the form of a dark rusty yellow froth.

The solution itself is always dull looking. Filtering is not necessary, but the bath should not contain any coarse undissolved particles of colour. These are liable to occur if the Nitrosamine Red has, through bad storage, caked on to the sides of the casks, forming a hard crust.

Meanwhile dissolve the acetate of soda in 2 gallons water, and stir it into the above Nitrosamine Red solution before use. Then add enough water to make 7 1/2 gallons developing liquor in all.

It must be expressly understood that in preparing this developing bath a maximum temperature of about 64 ° F. must not be exceeded.

If, through external conditions, or by entering the yarn, the bath becomes too warm, the consequence is a gradually progressing decomposition which means that towards the end of the operation no proper development takes place; in other words, the shades will come up yellower and streaky.
Nitrosamine Red on Cotton Yarn.

Under normal circumstances, the Nitrosamine Red solution, before being mixed with the acetate of soda, will keep for some days. When, however, the acetate of soda has been added, it may not be kept above 9 or 10 hours.

In places where crystallised acetate of soda can only to be purchased at a high price, dyers can produce it for themselves easily and cheaply; 21/4 lbs. crystallised acetate of soda can be replaced by a direct solution of

14 oz. soda ash in 3 lbs. 6° acetic acid 9° Tw.

To replace the 2 lbs. 12 oz. crystallised acetate of soda (required for the stronger developing liquor) take:

1 lb. 1 oz. soda ash
4 lbs. acetic acid 9° Tw.

In both cases dilute the acetic acid with several times its weight of cold water, and then stir in the soda slowly and gradually. A certain amount of care must always be taken whilst doing this, otherwise the whole will froth over; for the same reason it is well to make the mixture in a large vessel.

Dyeing.

Mix

3 1/4 gallons of the Nitrosamine Red solution
and 3 1/4 » » cold water (64° F. at the utmost)
in a wooden, enamelled, lead-lined, or earthenware vessel; enter the prepared completely dry but no longer warm yarn in handfuls (2 lbs. each); a red instantaneously forms on the fibre.

Copper vessels may not be used for the developing bath.

In working, take care to at once completely immerse the yarn in the developing liquor, and not grip it too tightly as the yarn should be saturated as quickly and completely as possible.

Give a few turns, wring slightly, give a few more turns, and wring thoroughly, taking care that the liquor wrung out of the yarn runs back into the bath.

Before entering another handful of yarn, always add 1/8 gallon fresh Nitrosamine Red solution to the bath, and so continue until all the yarn has been developed. With the last hank, the remainder of the solution will have been used.

For low counts of yarn, which absorb a deal of liquor, replenish with 1/2 gallon each time.
In this case 50 lbs. of yarn will require rather more than 8 gallons Nitrosamine Red solution in all.

This is composed as follows:

7 lbs. 12 oz. for the stronger naphthal liquor 9 lbs. 5 oz. Patent Nitrosamine Red in paste
2 » 14 » (» 15 » » » 8 » 5 » ) hydrochloric acid 22° Tw. (80°/o)
2 » 9 » (» 15 » » » 8 » 2 » ) acetate of soda crystallised.

The 2 lbs. 9 oz. crystallised acetate of soda can be replaced by:

1 lb. calcined soda
3 lbs. 13 oz. acetic acid 9° Tw.

The 3 lbs. 2 oz. crystallised acetate of soda can be replaced by:

1 lb. 3 oz. calcined soda
4 lbs. 9° acetic acid 9° Tw.
(diretions for making see above.)
Nitrosamine Red on Cotton Yarn.

As it is of great importance to rinse the yarns as quickly as possible, do not wait until the whole lot is developed, but allow another workman, who can likewise execute the other secondary jobs, to rinse each hank as soon as developed. If, owing to local conditions, an immediate thorough-rinsing is impracticable, rinse as well as possible provisionally, and put the whole batch through a second water later.

If anyone should desire to dye a larger lot of yarn in one bath, than 50 lbs., it is only necessary to bear in mind — in order to arrive at the quantities of liquor required — that $3\frac{1}{4}$ gallons is always the quantity commenced with, and that every 2 lbs. of yarn necessitates an additional $\frac{1}{6}$ gallon.

As a rule, the mordanting and developing liquors can be used for quantities up to 200 lbs. of yarn; after that, it is advisable to renew the liquor.

**Brightening.**

Prepare the following bath:—

66—77 gallons water $140^\circ$ F.
2 lbs. 10 oz. ordinary soap

and in it give the clean-rinsed hanks six turns; then pass them first through a warm and afterwards through a cold rinsing bath.

Finally hydro-extract and dry at not too high a temperature.

*Marseilles soap produces yellower shades than ordinary soap or soft soap.*

If passed through a further bath:—

66—77 gallons water $140-158^\circ$ F.
11 lbs. Turkey-red oil F 50\%/
1 lb. 5 oz. calcined soda

bluer, but not such bright shades are obtained.

The same principles apply, and the same precautions must be observed in the preparation with Beta-Naphthol and the subsequent developing with *Nitrosamine Red in paste*, as are described on page 488 and following pages.

When working with piece-goods, the impregnation with Beta-Naphthol solution is effected on the padding machine. It is advisable to have the rollers wrapped round with cloth. In addition to this there should be an arrangement for running in naphthol solution of the same concentration continuously—as fast as it is used up—from a tub placed near to the machine.

After being impregnated, the pieces are squeezed out as completely as possible and are then dried. This is best carried out in the hot-flue. (If such an apparatus is not available, an ordinary drying machine can be used. It is in this case advisable to wrap cotton cloth round the rollers, and care should be taken to dry the goods at the lowest possible temperature.)

After the dried goods have cooled down completely they are developed in a cold solution of Nitrosamine.

This takes place in a vessel of small capacity which is fitted with a system of rollers. Nitrosamine solution of higher concentration than that at first used (see later) is continuously run in from a vessel at the side in order to replace that which is used up in the production of the red and that which is carried away mechanically.

The formation of the red is instantaneous, and each part of the cloth only remains for a very short time in the developing solution.

After this process the goods are well squeezed out, thoroughly rinsed with sprays of water, soaped, and dried at a medium temperature on the cylinder drying machine.

**Preparation of the Beta-Naphthol solution.**

On an average 10 gallons of padding liquor are prepared as follows:—

2 lbs. of Beta-Naphthol
2 » » caustic soda 72—76° Tw.
1½—2 quarts of Turkey-red oil F and enough water to dilute it to 10 gallons.
Preparation of the developing solution.

10 gallons are prepared, for example, from:

- 4 lbs. 2½ oz. of Nitrosamine Red paste
- 2 » » hydrochloric acid 32° Tw. (30°/o) and a suitable quantity of cold water. Before use a concentrated cold solution of
- 2 » 1¼ » » acetate of soda crystals are added and the total volume should then equal 10 gallons.

For the details of the preparation of the Beta-Naphthol solution and the Nitrosamine solution, see pages 488 and 491.

Notes.

Attention is drawn to the fact that, according to the quantity of the material and the local conditions of working (pressure of the squeezing rollers, &c.) the concentration of the naphthol solution can be varied so that a maximum of 2½ lbs. and a minimum of 1½ lbs. is used for 10 gallons of liquor. The additions of caustic soda, &c. should be altered in exact proportion.

The conditions which determine the strength and amount of naphthol solution used, also determine the amount of Nitrosamine solution required. Suppose that 10 lbs. of material, whilst being prepared, absorbed 1 gallon of naphthol solution, and then afterwards absorbed or carried away 1 gallon of Nitrosamine solution, then the stock solution which is continually run into the Nitrosamine developing bath in order to keep up the strength of the same, will have to contain about 14 lbs. 9 oz. to 14 lbs. 11 oz. Nitrosamine Red in paste per 10 gallons.

It would therefore be prepared from about

- 14 lbs. 9 oz. of Nitrosamine Red in paste
- 7 » » hydrochloric acid 32° Tw.
- 7 » 4½ » » sodium acetate and enough cold water to bring it up to 10 gallons.

If, as is frequently the case, the developing bath is kept more concentrated from the beginning than in the above example, then the Nitrosamine solution which is run in to keep up the strength must be correspondingly more dilute.
Burl stain (Burl tincture).

It sometimes happens that the dyer wishes to hide the burls in pieces which have been dyed black or a dark colour.

The following recipe gives a stain which is suitable for smearing over these burls.

I. $2\frac{1}{2} \text{ oz.}$ solid logwood extract are dissolved in one gallon of water
II. $\frac{1}{7} \text{ » soda ash and}$
    $\frac{1}{6} \text{ » potassium chromate (neutral yellow salt)}$ are dissolved in $1\frac{3}{4} \text{ pints}$ of water.

The boiling solution I is slowly added to boiling solution II; the mixture is boiled for 10—15 minutes so that a clear blue-black solution is obtained.

After cooling sufficiently add $6\frac{1}{2} \text{ pints}$ of methylated spirits.

Notes.

a) The concentration of this stain can be regulated as desired by adding alcohol.

b) The solution should be applied with a quill. If it partially dries up in the glass dilute with spirit and not with water.
The fastness of our Aniline Dyes.

In the following pages our Aniline dyes are classified with regard to fastness. In the experiments which were made for this purpose we always tested the dyeings—the strength of which was as nearly as possible the same—under exactly the same conditions, e.g., to test the fastness to light dyeings produced from the various products were exposed at the same time.

However, as personal opinion differs to a great extent in this matter we cannot give any guarantee for the statements made. The idea of this classification is simply to render it easier for persons interested in these products to choose those with which to make their own trials.

Such trials are especially necessary in cases in which special demands are made, because local conditions and a number of other factors often influence the decision. For example, it is often the case that the same dyestuff is used for the same material in two different dye-houses and that it will withstand the milling process in one of them but not in the other.

This difference is not due to the dyestuff itself but to the different method of working.

Amongst other things it is especially difficult to form a correct opinion of the fastness to light.

Not only do the same colours frequently show a different degree of fastness on different materials (cotton, wool, silk), but also when fancy shades are produced on an uniform fabric, differences may arise due to varying amounts of colour being used and also because the eye is more sensitive to certain changes of shade than to others.
The following examples will illustrate what has just been said:

1. It may happen that a difference in fastness to light will be observed in two drab shades, although produced from the same dyestuffs (blue, red, and yellow) if one be reddish and the other greenish.

   In one case the red may perhaps appear to have faded and in the other to have held its own satisfactorily. In such cases the proportion of the colours present has perhaps less influence on this result than the fact that the fading of a drab shade towards red is not so unpleasantly striking to the eye as a change towards green.

2. In the case of a pink for which a large quantity of Rhodamine and only a little of Quinoline Yellow has been used the yellow will fade first although it is really faster to light than Rhodamine.

3. If a blue shade is produced from a bluish green which becomes greener on exposure, and from a violet which becomes much redder, it will probably remain good even though exposed for a considerable length of time, as the changes produced by light on these two colours neutralise each other favourably.

   It may therefore frequently happen that a faster blue shade can be produced from two colours which are not very fast than from a combination, the single colours of which are really faster to light than the above products, but which are affected in a more similar manner by the sun’s rays.

Notes.

In the following classification the same colour will frequently be met with in different groups. Where this is the case it has been rendered faster by an after-treatment (with copper sulphate, tannic acid, &c.).

If no note to this effect is made as to any product, it must be understood to have been dyed in the ordinary way and not subjected to any after-treatment.
Wool.

Solubility in acid liquors.

The following dyestuffs can be dissolved in hot acid liquids without any special difficulty:


Azocarmine, which is not mentioned in the above list, cannot be immediately completely dissolved in this manner, but as it dyes so exceedingly level it does not give rise to the slightest difficulty in the dyeing process.
Level-dyeing colours.

The following take the highest rank in respect to yielding level dyeings:

Acid dyes:

- Naphthol Yellow S, Fast Yellow G, Y. Azoflavine FF. Orange II.
- Sorbine Red, B.B. Azocarmine. Indigo Carmine and Indigotine brands.
- Wool Green S.

Basic dyes:


Substantive dyes:

- Oxamine Blue BG (does not dye quite as evenly as the preceding colours but is, nevertheless, in this respect the best of our substantive blues). Violet Black. Cotton Black B.N. Oxamine Black N, A.

The various substantive dyes just mentioned only give level shades if dyed in a neutral bath, i.e., when only Glauber's salt has been added to the dye-liquor. (See appendix to process 2, page 101.)

The following are extensively used and satisfy average demands with regard to evenness of dyeings.

Acid dyes:

Wool. Fastness to milling.

Basic dyes:—

*Victoria Blue B* (gives level blue shades if not used in conjunction with dyestuffs of another nature. Is dyed in an acid bath according to appendix, process 1, page 98).

*Fastness to milling.*

As there are very few Aniline Colours which withstand a severe milling, the experiments made in order to obtain the following classification consisted of the ordinary flannel milling. Those marked * do not bleed into white wool if the work is carefully performed. (The products which are not marked in this manner are also sufficiently fast for many purposes.)

The following are the fastest of the Aniline dyes in this respect:—

Acid dyes:—


Basic dyes:—


Eosine dyes:—

*The Eosine*, *Erythrosine*, *Phloxine*, *Rose Bengal* brands.
Wool. Fastness to water with regard to bleeding into white wool.

Substantive dyes:—

*Cotton Yellow G1*. Carbazol Yellow*. Cotton Orange G*, R*. Pyra-
Cotton Red 4B. Oxamine Red. Oxamine Blue A*, B*, BG*. Oxamine
Green MN*. Phenamine Blue R*. Oxamine Blue RRR*. Violet Black*.
Cotton Black BN*. Oxamine Black N*, A*.

In the case of *Cotton Yellow G1*, Carbazol Yellow, Oxamine Red,
Oxamine Maroon, Oxamine Green MN, Oxamine Claret M, Oxamine
Garnet M the fastness to milling is rendered still better by after-chroming.

Fastness to water with regard to bleeding into white wool.

The following can be classed as the fastest of the Aniline Colours in this
respect:—

Acid dyes:—

*Brilliant Yellow S*. Palatine Chrome Brown A, W. Scarlet RR, RRR.
Wool Scarlet 4 R. Cochineal Red A. Fast Scarlet B. Erythrine X, P.
Fast Red E, C, B. Mars Red G. Naphthol Red G, S. Palatine Chrome
Red R. Palatine Chrome Violet. The *Soluble Blue* and *Pure Blue*
brands. Alkali Blue 6 B and the other greenish brands (dyed according
to process 3, page 101). *Neptune Green S, S.B. Blue Black B*. The
*Brilliant Black* brands, if treated with chrome alum after dyeing.

Eosine dyes:—

*Eosine BN*.

Substantive dyes:—

Brown MN. Cotton Orange G, R. Pyramine Orange 3G, R. Thiazine
Red GW. Oxamine Claret M. Oxamine Blue A, B, BG, RRR.
Phenamine Blue G.
Wool. Fastness to stoving.

The following satisfy average demands with regard to fastness to water:

Acid dyes:

*Tartrazine. Orange G, R* (both products are only moderately fast but still they are the fastest of the orange dyes). *Wool Scarlet RR, RRR. Palatine Scarlet RRR, RRRR. Crystal Scarlet. Fast Red AV. Palatine Red A. Red Violet 5RS, 4RS. Acid Violet 3BN, 4BL, 7B* (are only moderately fast but still are the fastest of the violets). The *Indigo Carmine* and *Indigotine* brands. *Alkali Blue* (the greenish brands). *Bluish Green S. Light Green S, SF yellow shade, SF blue shade. Acid Green GB.* The *Brilliant Black* brands (without after-treatment with chrome alum).

Eosine dyes:

The *Erythrosine* and *Rose Bengal* brands.

Fastness to stoving.

The following are the fastest of the Aniline Colours in this respect:

Acid dyes:


Basic dyes:

*Auramine G, II. Rhodamine B, G* (appendix, dyeing process 1, page 98 or process 10 or 12, page 110—112). *Victoria Blue B, 4R. Night Blue* (appendix, dyeing process 1, page 98 or process 10 or 12, page 110—112).
Eosine dyes:—

The Eosine, Erythrosine, Phloxine, and Rose Bengal brands.

Substantive dyes:—

*Thiazine Red R* * Oxamine Blue B.*

The following are extensively used. They satisfy average demands.

**Acid dyes:**


**Basic dyes:**


**Substantive dyes:**

Wool. Fastness to carbonisation.

The following are the fastest Aniline dyes in this respect:

**Acid dyes:**
- Quinoline Yellow
- Naphthol Yellow S
- Tartrazine
- Palatine Chrome Brown A, W
- Orange G, H
- Silk Red N
- The Scarlet, Palatine Scarlet, and Wool Scarlet brands
- Cochineal Red A
- Fast Scarlet B
- Crystal Scarlet
- Fast Red AV, E
- Mars Red G
- Naphthol Red G, S
- Palatine Red A
- Palatine Chrome Red R
- Azocarmine
- The Acid Magenta brands
- Red Violet 3BN, 4BN, 4BL, 6BN, 7B
- The Soluble Blue, Indigo Carmine, Indigotine, Wool Blue, and Fast Blue brands
- Wool Green S
- Bluish Green S
- Neptune Green SB
- Light Green S
- SF yellow shade
- SF blue shade
- Acid Green GB
- The Brilliant Black and Palatine Chrome Black brands

**Basic dyes:**
- Rhodamine B, G

**Eosine dyes:**
- The Eosine, Erythrosine, Phloxine, and Rose Bengal brands

**Substantive dyes:**
- Thiazine Brown G
- Oxamine Brown M
- Pyramine Orange R
- Thiazine Red GW and RW
- Oxamine Blue A, RX
- Phenamine Blue G, B

The following dyestuffs are also extensively used. They are quite fast enough to satisfy average demands.

**Acid dyes:**
- Fast Yellow G, Y
- The Azoflavine brands
- Metanil Yellow
- Orange N
- Sorbive Red, B.B
- Fast Red E
- Acid Violet 4R
- Alkali Violet 6B

**Basic dyes:**
- The Methyl Violet brands

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Fastness to steaming.

The following are the fastest of the Aniline Colours in this respect:

**Acid dyes:**


**Basic dyes:**


**Eosine dyes:**

The Eosine, Erythrosine, Phloxine, Rose Bengal brands.

**Substantive dyes:**


The following are used on the largest scale for dyeing piece-goods. They do not give rise to any difficulty when the pieces are steamed.

**Acid dyes:**


**Basic dyes:**

Victoria Blue B, 4R (dyed according to appendix, process 1, page 98).
Fastness to light.

The following are some of the fastest of the Aniline Colours in this respect:

Acid dyes:


Substantive dyes:


The following products are extensively used and satisfy average demands with regard to fastness to light.

Acid dyes:

*Quinoline Yellow. Metanil Yellow. The Azoflavine brands. Orange N, II. The Acid Rhodamine brands.* (They are not so fast as the other above-mentioned products but are faster to light than any dyestuffs of this shade), The Scarlet brands. *Crystal Scarlet. Fast Red E. Naphthol Red S, G. Mars Red G.* The Indigotine and Indigo Carmine brands. *Light Green S, SF yellow shade, SF blue shade. Acid Green GB. Bluish Green S.* The Palatine Black brands.

Basic dyes:

*Rhodamine G, B* (dyed in a slightly acid bath, appendix, process 1, page 98).

With regard to fastness to light refer to what has been said under Acid Rhodamine.

Substantive dyes:

*Thiazine Red R, RW.*
Fastness to washing.

The following are the fastest to washing of their kind:

**Acid dyes:**

- *Quinoline Yellow*. The *Azoflavine* brands. *Palatine Chrome Brown A, W.*
- *Orange R.* *Fast Red AV.* *Fast Scarlet B.* *Palatine Chrome Red R.*
- *Palatine Chrome Violet.* *Acid Violet 4 BN, 4 BL.* The *Alkali Violet* brands (dyed according to appendix, process 2, page 100). *Wool Green S.*
- The *Palatine Chrome Black* brands.

**Basic dyes:**


**Eosine dyes:**

The *Eosine, Erythrosine, Phloxine, Rose Bengal* brands.

**Substantive dyes:**

- *Cotton Yellow G I*. *Carbazol Yellow†*. *Cotton Brown RN.*
- *Cotton Orange G, R.* *Pyramine Orange 3 G, R, RR.*
- *Cotton Red 4 B.*
- *Oxamine Red‡*. *Oxamine Blue A, B, BG.*
- *Oxamine Green M‡*. *Oxamine Claret M‡*. *Oxamine Garnet M‡*. The *Phenamine Blue* brands. *Cotton Black B N.*

Those products marked † are rendered somewhat faster to washing if the dyeings are after-chromed.
Wool. Fastness to street dirt.

Fastness to street dirt
(also fastness to alkalies).

The following are the fastest of their kind in this respect:—

Acid dyes:—

Basic dyes:—

Eosine dyes:—
The Eosine, Erythrosine, Phloxine, and Rose Bengal brands.

Substantive dyes:—
All of our products of this nature which are used for wool are fast enough in this respect.

The following products are extensively used. They are fast enough to street dirt to satisfy all average demands.

Acid dyes:—
Fastness to perspiration.

Practical tests (wearing) have proved that the following dyestuffs are the fastest of their kind:

**Acid dyes:**

**Basic dyes:**

**Eosine dyes:**
- The Eosine, Erythrosine, Phloxine, Rose Bengal brands.

**Substantive dyes:**
Wool. Fastness to acids.

Fastness to acids.

The testing of fastness to acids is so varied and so arbitrary that it is difficult to give a list of those products which satisfy all demands.

At all events it should be pointed out that a large number of dyestuffs are not mentioned in the following list although they are used on the largest scale and are found perfectly suitable for their particular purpose.

For example we might mention: — Naphthol Yellow S. Fast Yellow G, Y. Orange N. Metanil Yellow. Azoflavine RS. Acid Violet 3 BN, 4 BN, 4 BL, 6 BN, 7 B. Victoria Blue B. Wool Blue S, SL, R. Wool Green S.

The following are considerably faster than the average and may be considered as the fastest of their kind: —

Acid dyes:—


Basic dyes:—

Substantive dyes:—


Fastness to ironing.

The following may be classed as the fastest of our Aniline dyes in this respect:—

Acid dyes:—


Basic dyes:—


Eosine dyes:—

Phloxine GN.
Wool. Fastness to ironing.

Substantive dyes:—


The shades of the following change to a certain extent on ironing but on cooling the original shade returns. They are used on the largest scale and satisfy average demands.

Acid dyes:—


Basic dyes:—

Rhodamine B, G, 3B (appendix, process 1, page 98).

Eosine dyes:—

Eosine A, BN.

Substantive dyes:—

Cotton.

Level-dyeing colours.

The following give specially level dyeings:

Substantive dyes:


All direct colours which are not mentioned here dye as level as the average of substantive dyes. They therefore dye sufficiently evenly to satisfy average requirements and are very extensively used.

Any difficulty of this kind which may arise can easily be removed by suitably altering the conditions of dyeing. (See page 143 and following pages.)

Basic dyes (on a mordant of tannin and antimony):


The Cotton Blue brands. *Indoine Blue BB, BR, BBN* (dye sufficiently evenly if our special process page 482 is made use of). Nile Blue R.

Also the following acid dyes:

The *Soluble Blue* and *Nigrosine* brands (on a tannin mordant).

If sufficient care is taken the following also dye level shades and they are extensively used:


**Note.**

With regard to the evenness of shades produced with basic colours it should also be noticed that the strength of the mordant has a great influence on the result. For example, if a strong mordant is used for light shades it may give rise to uneven dyeings which under normal conditions are never met with.

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**Fastness to sizing.**

Basic dyes can almost always be rendered faster to sizing by an after-treatment with tannin. If the goods are also passed through a solution of antimony salt the dyeings are rendered still faster.

The dyeings mentioned below are classified without subjection to such a treatment except in cases where a note to contrary is added.

The following Aniline dyes are the fastest of their kind:

Substantive and developed colours:

Basic dyes:

\[ \textit{Auramine II} \text{ treated with tannin. } \textit{Rheonine A, N, treated with tannin. } \]
\[ \textit{Phosphine N} \text{ treated with tannin. } \textit{Rhodamine 6G, B, S, 3B, treated with tannin. } \]
\[ \textit{Saffranine MN} \text{ treated with tannin. } \textit{Methyl Violet BB} \text{ treated with tannin. } \]
\[ \textit{Victoria Blue R, 4R}, \text{ treated with tannin. } \textit{New Blue S} \text{ treated with tannin. } \]
\[ \textit{Nile Blue A, R}, \text{ treated with tannin. } \textit{Cotton Blue BB} \text{ treated with tannin. } \]
\[ \textit{Dark Blue B, R}, \text{ treated with tannin. The } \textit{Indoine Blue} \text{ brands treated with tannin. } \]
\[ \textit{Diamond Green B, G}, \text{ treated with tannin. } \]

The following are fast enough for most practical purposes. It depends of course on whether the goods are sized warm or at the boil, and on whether a sensitive shade from a mixture of dyestuffs is to be treated, &c.

Substantive or developed colours:

\[ \textit{Cotton Orange G} \text{ (for cream shades). } \textit{Sulphine} \text{ diazotised and developed with Alpha-Naphthol or Oxamine Developer B. } \]
\[ \textit{Oxamine Red} \text{ (for pinks). } \textit{Oxamine Red} \text{ developed with Nitrosamine solution. } \]
\[ \textit{Oxamine Violet} \text{ diazotised and developed with Alpha-Naphthol, Beta-Naphthol, or Oxamine Developer B. } \]

Basic dyes:

\[ \textit{Rheonine A. Rhodamine 6G. Saffranine T extra} \text{ treated with tannin. } \]
\[ \textit{Victoria Blue B} \text{ treated with tannin. } \textit{Nile Blue BB} \text{ treated with tannin. } \]
\[ \textit{Cotton Blue R} \text{ treated with tannin. The } \textit{Methylene Blue} \text{ and } \textit{Marine Blue} \text{ brands treated with tannin. } \]
\[ \textit{Diamond Green G, B}. \]

Mordant dyes:

\[ \textit{Dark Green in paste}. \]
Fastness to chlorine.

The following are the fastest of the Aniline Colours to chlorine, but it must be borne in mind that only very few of them will withstand a severe treatment. Trials should therefore be made in each case.

Substantive or ingrain colours:

* Sulphine* diazotised and developed with bleaching powder solution, phenol, or soda. *Pyramine Orange R.* *Pyramine Yellow G.* *Nitrosamine Red in paste.* *Aniline Black.*

Basic dyes:


Fastness to light.

The following are amongst the fastest of the Aniline Colours:

Substantive or ingrain colours:

*Cotton Yellow G, G I.* *Pyramine Yellow G.* *Sulphine* diazotised and developed with bleaching powder solution. *Sulphine* diazotised and developed with phenol and afterwards treated with copper salts. *Cotton Yellow R* treated with copper salts. *Nitrosamine Red in paste.* *Oxamine Maroon* and *Oxamine Red* developed with Nitrosamine solution and afterwards treated with copper salts. *Oxamine Blue A* treated with copper salts. *Sulphine* diazotised and developed with Beta-Naphthol, then treated with copper salts. *Oxamine Black N, A,* diazotised and developed with Beta-Naphthol and then treated with copper salts. *Oxamine Black N, A,* diazotised and developed with Oxamine Developer M. *Aniline Black.*
Cotton. Fastness to light.

Sulphur dyes:

*Kryogene Brown* (treated with copper salts still better). *Kryogene Brown G.*

Basic dyes (on tannin-antimony mordant):


The following are fast enough to light to fully satisfy average demands:

Substantive or ingrain colours:


Basic dyes:

The following Aniline dyes are the fastest of their class to washing.

(The products marked * in the following list do not bleed at all, or not noticeably, into any white cotton which may be present, if washed under ordinary conditions.)

**Substantive or developed colours:**


**Sulphur dyes:**


**Basic dyes (on tannin-antimony mordant):**


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Cotton. Fastness to boiling acid-liquors.

The following are used on the largest scale and have proved fast enough to satisfy average demands:

Substantive dyes:


Basic dyes:


Also: Dark Green in paste*.

Fastness to boiling acid-liquors.

The following are the fastest Aniline Colours of their kind:

Sulphine diazotised and developed with Beta-Naphthol. Oxamine Violet diazotised and developed with Oxamine Developer B. Oxamine Violet diazotised and developed with Beta-Naphthol. Oxamine Violet diazotised and developed with Oxamine Developer M. Oxamine Black N, A, diazotised and developed with Beta-Naphthol or Oxamine Developer M. Aniline Black (Oxidation Black). Fast Black B, B.S. Kryogene Black G, B. Kryogene Brown, G. Kryogene Olive.
Most of the dyestuffs just mentioned are used in actual manufacture for warp dyeing (warps for plush, &c.).

The following products are recommended for trial for the above and other purposes, e.g., decorative threads in woollen piece-goods, two-colour effects on unions, as some of them are extensively used on a large scale for these purposes.

Substantive or developed colours:


Basic dyes:

Silk.

Fastness to light on unweighted silk.

The following are the fastest Aniline Colours of their kind:

Acid dyes:


Basic dyes:

Night Blue (in full shades). Diamond Green G.

Substantive dyes:


Developed dyes:

Sulphine diazotised and developed with soap solution, phenol, or resorcine. Sulphine diazotised and developed with Beta-Naphthol.
Silk. Fastness to light on unweighted silk.

Spirit dyes:—

*Quinoline Yellow soluble in spirit. Parme soluble in spirit. Spirit Blue. The Japan Black brands.*

The following products are not so fast as the above but still they possess a good fastness to light. In some cases no faster substitute is known.

Acid dyes:—


Basic dyes:—


Eosine dyes:—

The fastest of this group is Eosine BN.

Substantive dyes:—

Oxamine Brown M. Salmon Red (in dark shades). Thiazine Red G. Phenamine Blue B.

Developed dyes:—

Sulphine diazotised and developed with Alpha-Naphthol. Oxamine Violet diazotised and developed with Alpha or Beta-Naphthol. Oxamine Blue RRR diazotised and developed with Alpha or Beta-Naphthol or Oxamine Developer B.

Spirit dyes:—

Fastness to light on tin-weighted silk.

The following Aniline Colours are the fastest of their kind to light:

**Acid dyes:**


**Basic dyes:**

*Rheonine A, N.* *Phosphine N.* *Induline Scarlet.* The Diamond Magenta brands.

**Eosine dyes:**

*Eosine BN.*

**Substantive dyes:**

*Cotton Yellow R.* *Thiazine Brown G,* R. *Pyramine Orange 3G,* R. *Thiazine Red R.* *Oxamine Claret M.*

**Developed dyes:**

*Sulphine* diazotised and developed with soap solution, phenol, resorcine, Oxamine Developer M. *Sulphine* diazotised and developed with Beta or Alpha-Naphthol. *Oxamine Violet* or *Oxamine Blue RRR* diazotised and developed with Oxamine Developer M.

**Spirit dyes:**

*Quinoline Yellow soluble in spirit.* The Japan Black brands.
Silk. Fastness to light on tin-weighted silk.

The following are not so fast as those just mentioned but still they are comparatively fast to light:

**Acid dyes:**


Fast Blue RR, greenish. Neptune Green S. Nigrosine W, WL.

**Basic dyes:**

Auramine G. Rhodamine G, B, 3B (are only moderately fast to light but are the fastest colours of this shade). Saffranine T extra. Red Violet 5R extra. Indoine Blue BB, BR. Nile Blue BB.

**Substantive dyes:**


**Developed dyes:**

Oxamine Blue RRR diazotised and developed with Alpha-Naphthol, Beta-Naphthol, or Oxamine Developer B.

**Spirit dyes:**

Fastness to light on tannin-weighted silk.

The following are the fastest of their kind in this respect:

**Acid dyes:**


**Basic dyes:**

Rhodamine G, B, 3 B. Nile Blue A. Diamond Green G.

**Substantive dyes:**


**Developed dyes:**

Sulphine diazotised and developed with soap solution, phenol, or resorcine. Sulphine diazotised with Beta-Naphthol. Oxamine Violet diazotised and developed with Oxamine Developer M. Oxamine Blue RRR diazotised and developed with Oxamine Developer M.

**Spirit dyes:**

Quinoline Yellow soluble in spirit. Japan Black extra.
Silk. Fastness to light on tannin-weighted silk.

The following products are not so fast to light as those mentioned above but still they possess a good fastness to light:—

**Acid dyes:**—


**Basic dyes:**—


**Eosine dyes:**—

Eosine BN.

**Substantive dyes:**—

Oxamine Claret M. Phenamine Blue B, G.

**Developed dyes:**—

Sulphine diazotised and developed with Oxamine Developer M or Alpha-Naphthol. Oxamine Violet diazotised and developed with Beta-Naphthol, Alpha-Naphthol, or Oxamine Developer B. Oxamine Blue RRR diazotised and developed with Alpha or Beta-Naphthol or Oxamine Developer B. Cotton Black 3B developed with Nitrosamine solution.

**Spirit dyes:**—

Fastness to water of dyeings with regard to bleeding into white silk.

The following are the fastest of their kind in this respect:—

**Acid dyes:**


**Basic dyes:**


**Substantive dyes:**

Developed dyes:—

Sulphine diazotised and developed with soap, phenol, or resorcin and treated with tannin. Sulphine diazotised and developed with Beta-Naphthol and treated with tannin. Oxamine Violet diazotised and developed with Alpha-Naphthol or Beta-Naphthol, and treated with tannin. Oxamine Blue RRR diazotised and developed with Beta-Naphthol and treated with tannin. Oxamine Black N, A, diazotised and developed with Beta-Naphthol or Oxamine Developer M (or both combined).

Spirit dyes:—


The following products are fast enough to satisfy the average requirements. It should be borne in mind that light shades produced with a colour may be fast to water whereas dark shades produced with the same colour may not be fast.

Acid dyes:—


Basic dyes:—

Silk. Fastness to water with regard to bleeding into white silk.

Eosine dyes:—

*Phloxine GN* treated with tannin.

Substantive dyes:—


Spirit dyes:—

*Quinoline Yellow soluble in spirit.*
Concentrated brands.

We deliver a number of our dyes in countries where there is a duty upon Aniline Colours in a more concentrated form; but, we prefer, in countries which do not impose such duties, to sell the well-known brands possessing the concentration customary in the trade.

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Concentrated brands.

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