THE

PRACTICAL

SCOURER AND GARMENT DYER.

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COMPRISING

DRY OR CHEMICAL CLEANSING, THE ART OF REMOVING STAINS.
FINE WASHING, BLEACHING AND DYEING OF STRAW
HATS, GLOVES AND FEATHERS OF ALL KINDS,
DYEING OF WORN CLOTHES OF ALL FABRICS, INCLUDING
MIXED GOODS, BY ONE DIP,

AND THE

MANUFACTURE OF SOAPS AND FLUIDS FOR
CLEANSING PURPOSES.

EDITED BY
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ILLUSTRATED.

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PREFACE.

CHEMISTRY plays such an important part not only in the industries but also in the household, especially as regards washing and the removal of stains, that no apology is needed for the publication of a work, the aim of which is to give practical and approved methods for dry or chemical scouring, the art of removing stains, fine washing, bleaching and dyeing straw hats, cleansing and dyeing gloves, dyeing feathers and garments, as well as a large amount of other useful information.

The book being intended not only for the professional scourer and dyer, but also for use in the family, it has been endeavored to avoid all unnecessary technicalities and to give the various processes in such a way as to make them readily understood and easy of execution.

The editor desires to acknowledge his indebtedness to the German works "Die Kunst-und Fein-Waescherei" by Victor Joclet, and "Die Putzfedernfaerberei und Lappenfaerberei" by Louis Lau, from which he has freely drawn, several entire chapters having been translated from them, and takes pleasure in expressing his obligations to the enterprising publishers for the assist-

ance rendered to him by a liberal supply of books and journals.

Finally, it remains only to be stated that the book has been provided with a copious table of contents and a very full index which will render any subject in it easy and prompt of reference.

W. T. B.

PHILADELPHIA, Dec. 15, 1892.

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THE

PRACTICAL SCOURER AND GARMENT DYER.

I.

DRY OR CHEMICAL CLEANSING.

No other branch of a modern industry is veiled in as much mystery, and yet so simple, as the so-called dry cleansing for the removal of dirt from worn garments and stuffs. It was introduced, in 1866, by M. Judlin, and is now almost everywhere used in large cities.

Dry cleansing simply consists in removing the dirt from worn stuffs with the assistance of oil of turpentine, benzine, benzol, or another fluid capable of dissolving grease.

Most dirt-stains consist of grease or resin covered with dust or a coloring-matter. By removing the grease or resin the dust loses its hold and the stain disappears.

As previously stated, for this cleansing process are used either, *a*, oil of turpentine; *b*, benzine; or *c*, benzol.

Oil of turpentine is obtained by distilling the oleoresinous exudation of various species of *Pinus*. The crude turpentine is put into a large still, heat is applied, and a little water from time to time added to the contents of the still. The distillation is continued as long as oil passes over, when the resinous mass is run off through a stop-cock placed at the bottom of the still, is passed

through several strainers, and then constitutes *rosin*. On condensing the distillate, the oil of turpentine separates from the water, and is dipped into the barrels in which it enters commerce.

Oil of turpentine is a colorless, thin, volatile liquid, the density of which varies between 0.855 and 0.87. When recently rectified, it boils at about 302° F., but the temperature usually rises as the distillation progresses, and old oil does not generally commence to boil below 311° or 320° F.

Of the different varieties of oil of turpentine the French oil is the best, it possessing a somewhat finer odor. Next in order is the American oil of turpentine, while the Austrian product cannot be so highly recommended, it always showing a slightly yellowish color, even when thoroughly rectified.

German oil of turpentine, obtained by the dry distillation of various species of *Pinus*, should not be used, it possessing a peculiar odor which cannot be removed from the stuffs treated with it. Besides, it rapidly turns yellow in the air, and resinifies.

Although oil of turpentine is an excellent solvent for resins, fats, etc., it possesses the disadvantage of rapidly absorbing oxygen from the air and resinifying. For this reason it is but seldom used, and then only when thoroughly rectified over lime, chalk, chloride of lime, or similar substances, and if it has not been stored for any length of time.

There is no good reason for the generally prevailing idea that oil of turpentine, when used for cleansing silk stuffs, imparts to them a soft feel, an increased lustre and softness.

Benzine or petroleum benzine. This fluid must not be confounded with *petroleum ether.* The latter is a colorless, ethereal, very inflammable liquid, which evolves gas at as low a temperature as 86° F., and commences to boil at 122° to 140° F.

Benzine is the portion of crude petroleum which passes over at between 212° and 284° F. In a pure state it is colorless, very mobile, possesses a peculiar odor, and is one of the best solvents for fats, resins, etc. If it is to be used for cleansing purposes, it should not leave behind a residue or any odor when evaporated in a porcelain dish.

Benzol. It is this fluid which is generally used, and to it is chiefly due the great reputation dry cleansing at present enjoys, because the operation proceeds very rapidly, and the lustre and finish of the stuffs suffer no injury whatever.

Benzol is obtained from coal-tar, one of the secondary products of coal-gas manufacture. It is colorless, of considerable refractive power, mobile, of a peculiar, not disagreeable odor, boils at from 176° to 212° F., and burns with a bright flame, depositing much soot.

Besides the above mentioned benzin and benzol, there is also found in commerce the so-called *brown-coal benzin;* it is distinguished from a good quality of benzol by its odor, which resembles radish and onions.

To distinguish benzol from petroleum benzin and to test the former as to its purity, proceed as follows :—

Mix 2 parts of concentrated sulphuric acid with 1 part of strong nitric acid (1.84 specific gravity). Into this mixture allow to flow, with constant cooling, 1 part of the benzol to be tested, and finally heat gently to

about 140° F. Then pour the cold mixture into water. By the action of the nitric acid upon pure benzol, nitrobenzol is produced, which separates on the bottom of the glass as a heavy oily fluid with a strong odor resembling that of oil of bitter almonds, while the greater portion of the petroleum benzin, which remains unchanged, floats as a light, colorless layer upon the surface. However, small portions of petroleum benzin may be admixed with the nitrobenzol. Therefore, pour over the product separated by the water dilute sulphuric acid, and for some time treat the fluid with metallic zinc until a vigorous evolution of hydrogen takes place. The nitrobenzol is thereby reduced to aniline, while the petroleum benzin remains unchanged. By subjecting the very acid fluid to distillation, aniline sulphate remains behind, while the petroleum benzin passes over.

As a simpler method for distinguishing benzol from petroleum-benzin, Pusch recommends iodine, which dissolves in the latter with a raspberry-red, and in benzol with a violet-red color; the former color is so intense that a small admixture of benzin can be recognized by neutralizing the violet tint.

The employment of benzol for technical purposes is based upon the following properties: It dissolves all fats as well as most resins, and has the great advantage, especially over oil of turpentine, of rapidly volatilizing without leaving behind the slightest odor.

By the absorption of atmospheric oxygen, oil of turpentine, as previously mentioned, is rapidly changed and resinifies, whereby it imparts a disagreeable odor to all articles, the product formed being no longer volatile.

Furthermore, even the most delicate colors of tissues

are not attacked by benzol, and new stuffs frequently acquire a much finer appearance when washed with it previously to being sold. In England this is frequently done with carpets, whereby the grease, which has penetrated into the tissue during fabrication, is removed, and the colors appear in their full splendor.

There are a number of methods for executing dry cleansing, according to whether the work is to be done on a large or a small scale.

In the latter case the procedure is as follows:—

Five vessels sufficiently large to allow of the convenient handling of the stuffs to be treated in them are used. The vessels may be of zinc-sheet, though it is better to have them made of copper-sheet, or to employ large stoneware pots such as are much used in the chemical industry. Each vessel should be provided with a well-fitting lid. The vessels should be cylindrical in form and greater in depth than diameter.

Fill the vessels three-quarters full with benzol, and then sort the articles which are to be cleansed. Separate the lighter from the darker, and in this manner arrange several piles of articles. Spread out each article, first the lighter and last the darker, upon a table covered with zinc-sheet and remove the worst stains. For this purpose tie a piece of wadding, the size of a fist and made into a ball, into a piece of white linen so that the corners of the latter can be used as a handle. This contrivance is called a "tampion." Now dip the tampion into benzol in a dish until it is thoroughly saturated, and vigorously rub the dirtiest places until the greater portion of the dirt is removed. Proceed in the same manner with all the articles, the darker being taken last, because by

repeatedly dipping the tampion into the benzol, the latter acquires a darker color.

The benzol remaining after the operation is finished is poured into a large vessel, which is provided with a well-fitting lid. Now wash the articles treated with the tampion, one after the other, in vessel No. 1, throw them into vessel No. 2, and cover the latter. Then thoroughly wash lot No. 1 with the hands, and in the meanwhile bring the articles in vessel No. 2 into No. 3. Now throw the washed lot No. 1 into vessel No. 2, and then commence washing the next lot, bringing in the meanwhile the articles in vessel No. 3 into No. 4 and those in No. 2 into No. 3. The lot washed next is then thrown into vessel No. 2.

This changing of the articles from one vessel to the other is done for the purpose of always bringing the first lot, that is, the white pieces, in contact with pure benzol, the latter becoming constantly darker by washing the articles. The articles first treated are finally again washed in vessel No. 5, then spread out upon the table and examined. If dirty places are still found, the articles are rubbed with a clean tampion dipped into the benzol in vessel No. 5, and then for some time placed in vessel No. 5. From the latter they are thrown into a pot provided with a lid, in which the adhering benzol drains off and is from time to time removed by tilting the pot. The articles are finally wrung by passing them between the rolls of a wringer, or, still better, the adhering benzol is removed by means of a centrifugal worked by hand. The articles are then dried in quite hot, closed, drying-chambers, provided

with contrivances for the escape and condensation of the benzol vapors.

By this treatment the articles are thoroughly cleansed as far as can be done with benzol. It must, however, be mentioned that all stains produced by alkalies, acids, sugar, milk, etc., resist the action of benzol. The same is also the case with so-called sweat-stains, which are caused by a change in the color. To remove such stains, the separate places must be subjected to a special treatment, as will be explained later on.

The method above described is very practical, but possesses the inconvenience of the operator being much exposed to the vapors of the benzol. This may, however, be avoided by carrying on the work under a well-drawing chimney.

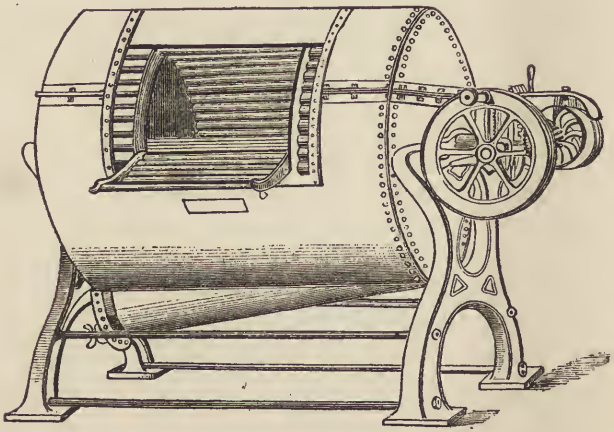
For draining the articles, a tall cylindrical vessel of zinc or copper, provided with a perforated false bottom, is generally used. The adhering benzol drains off through the perforated bottom, and is from time to time drawn off through a cock near the true bottom of the vessel. The vessel may also be provided with a movable lid and screw, so that by applying pressure this portion of the operation is accelerated.

Articles of silk are only washed by hand in the above described manner, as otherwise they would suffer too much. Moreover, if only separate stains are to be removed, the entire article, with the exception of the stained portion, remains intact, and is treated with the greatest care.

For working on a larger scale the above described process is not suitable, drums (wash-machines) which execute the washing in a closed space being employed.

The most simple arrangement of such a wash-machine (Fig. 1) is as follows: Upon a cast-iron frame rests a cylindrical casing, in the interior of which revolves a drum, the periphery of which is formed by a grating of

Fig. 1.



hollow iron pipes. In this drum, extending through its entire length in a radial plane, is a reticulate moulding of five pipes. The lower portion of the iron casing serves as a receptacle for the fluid, which can be discharged through a cock. The casing is closed by a slide.

The machine is filled about two-thirds full with benzol, and after placing the stuffs or garments to be cleansed in the drum, the latter, as well as the outer casing, is closed. The drum is then slowly and very regularly revolved, whereby the articles dip into the cleansing fluid and rub against each other and the rods of the drum. When the flat grating of the mould arrives below, which happens after each revolution, it

gathers up the articles, lifts them up, and allows them to fall down again. After the articles have thus been treated for a half to three-quarters of an hour, they are taken from the apparatus by lifting them with the assistance of the moulding to the height of the door, and allowed to drain off. They are then brought into the drying apparatus. For this purpose either a centrifugal or a drying-box is used. The centrifugal differs from the ordinary construction in that it is entirely closed, the discharge-pipe entering a vessel in which the benzol hurled out is caught.

The drying-boxes are generally of copper enclosed on all sides. They resemble an ordinary cupboard, except that they are provided with an arrangement whereby the adhering benzol, which volatilizes in the interior of the box, is conducted away and liquefied in a condenser.

The benzol used for washing becomes by that operation charged with dirty particles, which, after the benzol has stood for a few minutes, deposit upon the bottom of the drum. By opening the cock, and closing it at the proper time, the dirtiest portion of the fluid can be removed, and the contents of the drum purified without entirely emptying the latter.

The waste hydrocarbons—whether benzol or petroleum benzin—thus obtained are charged with particles of fat and dirt, either in solution or suspension.

In solution are, as a rule, only particles of fat and resin, which generally are neutral and only in very rare cases show an acid reaction, the latter being chiefly caused by free fatty acids, which frequently are of a volatile nature. To fix these free acids and remove them from the fluid, the used benzol has to be treated

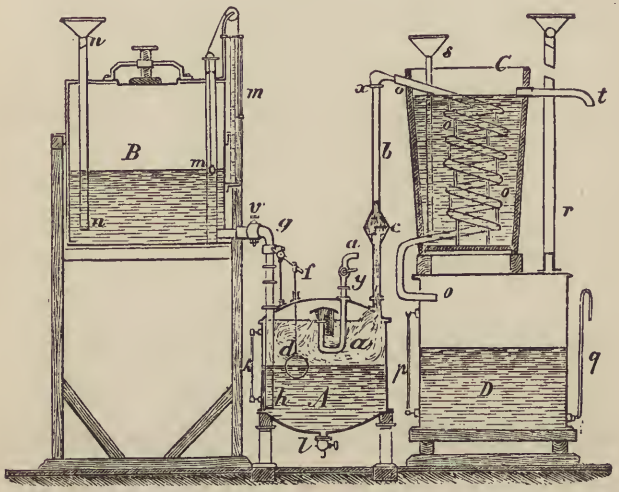
with caustic alkali or an alkaline carbonate, whereby a slight development of ammonia frequently takes place, which, however, need not to be taken into consideration.

Such impure benzol *never* contains substances for the removal of which a treatment with strong acids, for instance, concentrated sulphuric acid, would be required, and hence all methods describing such treatment should be rejected. The organic substances, whether in solution or suspension, contained in these impure fluids immediately develop, when brought in contact with sulphuric acid, sulphurous acid, which is absorbed with avidity by the benzol and can only be removed from it by subsequent careful washing with alkalies. If such treatment with alkalies is omitted, the sulphurous acid not only attacks the color of the stuffs, but also the fibres of cotton and linen, the latter suffering more than silk and wool. The simplest method of purifying the dark, and frequently perfectly black, benzol is as follows: Mix the fluid as it comes from the washing-machine with a dilute soda solution (about 10 quarts of soda solution to 1000 quarts of benzol). After separation has taken place, draw off the lye and wash the benzol with water. The benzol thus treated is subjected to distillation by means of a current of steam, and the distillate freed from water.

The apparatus shown in Fig. 2 is especially suitable for the distillation of the benzol treated in the above manner, it being distinguished by working continuously. *A* is a cylindrical vessel of sheet-iron or cast-iron with arched top and bottom, the latter being provided with a discharge-cock, *l*. The top is furnished with the inlet-pipe *h*, the float *d*, the steam-pipe *a*, and

the steam discharge-pipe *b*. At *k* is placed a glass gauge. In order to be enabled to observe the influx, the inlet-pipe *h* is, at *i*, provided with an intermediate glass tube. The float *d* is connected with the jointed lever *f* in

Fig. 2.



such a manner that in moving up or down it opens or closes the cock *g*. The pipe *a* for the admission of steam is bent upwards in the interior of the vessel and provided above its mouth with an arched iron plate, whereby the current of steam is uniformly distributed over the surface of the fluid. The pipe can be closed by the cock *y*. The pipe *b* for discharging the steam is, at *c*, provided with a so-called safety-funnel of the ordinary construction, which prevents any of the fluid to be distilled from being carried to the condenser. At *x* the pipe enters the worms *oo*. *B* is the reservoir for the fluid

to be distilled. In the cover of this reservoir, which is also constructed of iron, is a man-hole, so that it may be cleansed when necessary; *n* is the funnel-pipe for filling the reservoir, and *m* the gauge. On the bottom of the reservoir *B* is the discharge-cock *v*, which is directly connected with the pipe *h*. *C* is the cooling vessel with the worm *oo*, the inlet-pipe for water *s*, and the discharge-pipe *t*. Below the cooling vessel stands a cylindrical iron vessel, *D*, for the reception of the distillate. It is hermetically closed by a lid in which is secured the discharge-pipe for gas, *r*. In the funnel-like expansion of the upper end of *r* lies a light hollow metal ball which serves as a valve. On the bottom of the vessel *D* is a discharge-cock or a bent tube, *q*, so fixed that it is laterally inclined. The worm *o* enters the vessel below the cover. The vessel is further provided with a glass gauge, *p*.

The mode of working with this apparatus is as follows: The reservoir *B* being filled with the fluid to be distilled, the cock *v* is opened. Since the vessel *A* is still empty, the float *d* assumes its lowest position, the arrangement being such that then, by the jointed lever *f* connected with the float, the cock *g* is opened, and hence the fluid can pass from *B* to *A*. By the fluid gradually rising in *A* the float is lifted and the cock *g* gradually closed, until, when *A* is about two-thirds full, it is entirely closed and the influx interrupted. Now open the cock *y* for the admission of steam, and distillation will commence in a few minutes. Now since, with one volume of water in the form of steam 8 to 10 times the volume of hydrocarbons, according to the degree of their volatility and height of their boiling-points, are driven off, it is evident that the level in the vessel *A* will gradually

fall and the float *d* sink down, whereby the cock *g* is opened and a fresh influx in proportion to the decrease of the level in *A* produced. With continuous working so much waste-water collects in the vessel *A* that the cock *g* finally remains entirely closed in consequence of the high position of the float; hence, the discharge-cock *l* has to be occasionally opened. However, with careful manipulation it is not necessary to shut off the steam nor to interrupt distillation even for a few minutes. The distillate which collects in the vessel *D* consists of water and the oily hydrocarbons; the former is drawn off by occasionally inclining the pipe *q*. In the beginning of distillation the steam flowing into *A* forces out the air through the worm *o* to *D*, and from here through the pipe *r* into the open air, for which purpose *r* may be connected with a chimney. The previously mentioned metal ball in *r* is, however, absolutely required, otherwise a considerable loss of hydrocarbons by volatilization may be incurred.

With this apparatus from 2000 to 2500 quarts can be conveniently distilled in 12 hours, the quantity depending, of course, on the volatility and the boiling-point of the hydrocarbon to be purified.

As regards the drying-boxes, they are heated either by hot air or steam, the latter, if possible, superheated. The degree of heat required is from 158° to 167° F.

Dry or chemical cleansing may be employed for—

a. White silk fabrics and ribbons, and such as contain other colors, but in which white is nevertheless the prevailing color.

b. Woollen and half-woollen fabrics.

c. Silk-velvet and all other colored silk stuffs.

d. Light-colored woollen and half-woollen fabrics.

e. Dark-colored articles.

Less suitable for dry cleansing are half-silk fabrics, as well as cotton and linen stuffs.

Not suitable for dry cleansing are especially white linen and cotton pantaloons, vests, sun and rain umbrellas, satin shoes, etc. These articles, which, for reasons readily understood, cannot be brought into the wash machine, require cleansing by hand with the tampion and brush.

Colored articles which discolor when treated with the tampion must, of course, be separated to prevent other stuffs, especially white or those with a white ground, from becoming smeared. This generally happens with stuffs dyed with tar colors which have not been sufficiently steamed.

The cleansing of the articles, however, is actually not finished by treating them with benzol, it being necessary to examine them thoroughly for any stains which may still be present. If stains are found, the articles are drawn over a marble slab and the stains separately removed by means of water, soap, and brushes. Stains of oil-paint and resins are most obstinate in this respect.

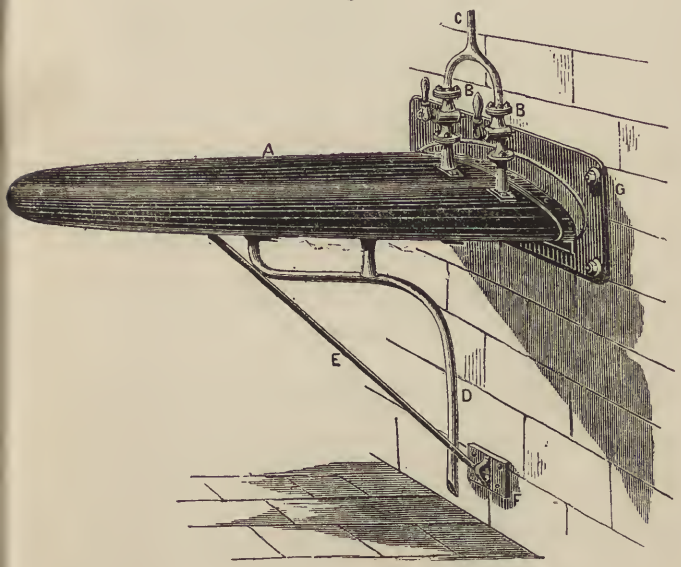
The most simple method of removing oil-paint stains is to rub them with a tampion dipped in clean oil of turpentine. Then place a piece of blotting-paper over and under the stain and pass a hot flat-iron over it. Finally wash the article in warm soap water.

Resin stains are treated in the same manner as oil-paint stains.

To remove the adhering benzol odor, the articles are finally hung up in an airy room, and are then brought into the ironing-room to be carefully ironed.

Very woolly articles which have become flat and compressed by ironing are finally drawn over the apparatus shown in Fig. 3. This is, so to say, a gigantic smooth-

Fig. 3.



ing-iron covered on top with a perforated copper plate upon which lies a stout felt cloth. On opening the cock *B* for the admission of steam, a dense volume of steam immediately rises over the entire surface of the smoothing-iron, which is allowed to act upon the back of the stuffs, whereby the surface is raised and appears as woolly as before.

It is scarcely necessary to state that in working with benzol, or petroleum benzin, and even with oil of turpentine, which, notwithstanding their comparatively

high boiling-points, volatilize at the ordinary temperature, the greatest care has to be observed. No open light or a stove should be allowed in the working-room, and special care must be taken to provide for thorough ventilation, there being nothing which causes explosions so readily as a mixture in certain proportions of the above-mentioned hydrocarbons with air.

II.

THE ART OF REMOVING STAINS.

GENERALLY speaking, a distinction is made between the removal of stains from white or not dyed stuffs, and from colored fabrics.

As regards the stains themselves, they are distinguished according to their condition and the nature of their formation. They may be broadly divided into two classes, viz: stains of a fatty and of a non-fatty nature. Furthermore, we have to consider stains which destroy the color of the fabric, and those which exert no effect upon it. In the former case the stain may be readily removed, but sometimes it will be impossible to restore the damaged color.

The removal of stains from white goods is accomplished with comparative ease, as the question of color does not come into consideration, and quite energetic means may be resorted to. It may be here added that in this case soap and water are the most radical means for cleansing. In difficult cases chlorine, sulphurous acid, and similar agents are employed.

Soap is also an exeellent agent for removing stains from eolored fabrics, provided the eolor is fast. For figured and trimmed articles it is, however, best not to use it, or at least very sparingly.

As agents for the removal of stains several chemicals are used, the principal ones of which will be mentioned and described below.

Besides oil of turpentine, petroleum benzine, and benzol, the properties of which have been previously described, there are used to a greater or less extent: *Ether, chloroform, alcohol, aqua ammoniæ (water of ammonia), glycerin, borax, sulphite and hyposulphite of sodium, pyrophosphate of sodium, magnesia, stannous chloride, chloride of lime, hypochlorites, chlorine-water, acetic, citric, hydrochloric, oxalic, and tartaric acids, ox-gall, etc.*

It is absolutely necessary that the chemicals used should be chemically pure, since, if they are contaminated by another body, it may happen that in removing an old stain a new one may be produced.

Ether. Pure ether is a colorless, very limpid fluid, of a peculiar, penetrating odor, and at first a very pungent taste; the after-taste is cooling, and should not be bitter. Ether is extraordinarily volatile, boils at from 93° to 95° F., and burns with a bright yellow flame, yielding water and carbonic acid. Its vapor mixed with a large quantity of air, if ignited, explodes with great violence. In consequence of this property and the great density of its vapor, extreme care should be exercised in handling ether or manipulating with it in the vicinity of a flame. The latter should *never* be done if it can possibly be avoided, nor should the ether be

allowed to stand in a warm room. Ether is miscible in all proportions with spirit of wine, but not with water, which dissolves one-tenth its volume. The presence of water and alcohol is detected by mixing the ether with an equal bulk of carbon disulphide, which should result in a perfectly clear liquid; a piece of potassium kept in the ether for 24 hours becomes coated with a yellowish film, and imparts a yellowish color to the liquid if alcohol be present. Aniline-violet is insoluble in absolute ether, but in the presence of 1 per cent. of alcohol colors the liquid distinctly.

Ether is an excellent solvent for fats and resins.

Chloroform. This is less dangerous than ether. It is a limpid, colorless, diffusive liquid, not inflammable, of an agreeable ethereal odor, a hot saccharine taste, and a neutral reaction. In a perfectly pure state it is difficult to keep, and hence some alcohol is added, so that its specific gravity varies between 1.488 and 1.492, and its boiling-point is increased to 149° F. When brought upon the skin chloroform evaporates rapidly, with the production of a cold sensation.

When chloroform is shaken in a perfectly clean glass-stoppered vial with an equal bulk of sulphuric acid, no color should be imparted to either liquid after remaining in contact for 24 hours. Should a coloration appear, the chloroform is not pure. If 5 centimeters of purified chloroform be thoroughly agitated with 10 cubic centimeters of distilled water, the latter, when separated, should not affect blue litmus-paper (absence of acids), nor test-solution of nitrate of silver (chloride), nor test-solution of iodide of potassium (free chlorine).

Chloroform is an excellent solvent for fats and fat oils, wax, resins, caoutchouc, etc.

Alcohol and spirits of wine are also used for the removal of various stains. Both are colorless, very mobile, and possess a peculiar odor and very pungent taste. When exposed to the air in a thin layer, they evaporate very rapidly without leaving a residue. They are very inflammable and burn with a non-luminous blue flame.

The only difference between alcohol and spirits of wine is that the latter contains more water than the former. Alcohol should be nearly anhydrous, and contain not more than 2 per cent. of water. It is miscible with water, ether, and chloroform, and gives clear mixtures with the majority of volatile oils.

Alcohol dissolves either entirely or partially fat oils, fats, and many resins. It is also a solvent for numerous other solid organic and inorganic combinations (salts, alkaloids, etc.).

Aqua ammoniæ (*water of ammonia*). This is one of the most important agents for the removal of stains. It forms a colorless fluid, with a strong, penetrating odor and a pungent, acrid taste. When highly concentrated it reddens the skin and produces blisters. It imparts a brown color to turmeric-paper, a blue color to red litmus-paper, and a green color to the juice of violet flowers.

The specific gravity of aqua ammoniæ decreases with an increasing content of ammonia. Two varieties are generally distinguished in commerce: *Water of ammonia*, which is an aqueous solution of ammonia, having the specific gravity 0.960 at 57.2° F. and containing 10 per cent. by weight of the gas. *Stronger water of*

ammonia has the specific gravity 0.891, and contains 28 per cent. by weight of the gas.

Water of ammonia should evaporate at the temperature of boiling water without leaving any residue (salts). On being neutralized with an acid, no empyreumatic odor should be observed. It should not yield a precipitate with lime-water (carbonate), with oxalate of ammonium (calcium), or, either before or after neutralizing by means of nitric acid, with sulphuretted hydrogen.

In using water of ammonia for the removal of stains, it must be ascertained whether any of the colors are changed by it.

Glycerin is a syrupy liquid having the specific gravity 1.28 at 59° F. It is transparent, colorless, inodorous, very sweet, and somewhat warm to the taste, oily to the touch, without action upon litmus, and soluble in all proportions in water and alcohol; also in spirit of ether, but not in ether, chloroform, benzol, fixed oils, or volatile oils.

Glycerin is a solvent for alkalies, alkaloids, dye-stuffs, and other bodies. It also serves for finishing fine fabrics, etc.

Borax. Borax forms large, colorless, monoclinic prisms, which are transparent, inodorous, have a mild, sweetish, cooling, and afterwards alkaline taste, and in dry air effloresce superficially and become opaque. It is soluble in 12 to 15 parts of cold, and in 2 parts of boiling water, and in 4 to 5 parts of glycerin, but insoluble in alcohol. The aqueous solution has a slightly alkaline taste, colors red litmus-paper blue, and the juice of violet flowers green.

Borax is very frequently adulterated with Glauber's

salt (sodium sulphate), rock-salt (sodium chloride), and potassium chloride. If, in a dilute and heated solution strongly acidulated with hydrochloric acid, a heavy precipitate is formed by barium chloride solution, Glauber's salt may be supposed to be present. An admixture of rock-salt is recognized by the white flakes which are formed in an aqueous solution acidulated with nitric acid by the addition of nitrate of silver. Potassium chloride is recognized in the solution by the formation of a white crystalline precipitate on adding a large quantity of tartaric acid. The presence of carbonate of soda is shown by the effervescence of the solution on adding hydrochloric acid.

Borax is used for fixing mineral dye-stuffs, as an addition to starch, and as a substitute for alkalies (potash, soda).

Hyposulphite of sodium occurs in commerce in large, transparent, colorless, monoclinic prisms or plates, which have the specific gravity 1.74, are neutral or faintly alkaline, are inodorous, and have a cooling, bitter, slightly alkaline, and sulphurous taste. It is permanent in the air, soluble at a medium temperature in less than an equal quantity of water, but insoluble in spirits of wine. By adding an acid to the aqueous solution gaseous sulphurous acid escapes, while sulphur separates in white flakes.

It is used as a bleaching agent, and also as a dechlorizing agent for fabrics bleached with chlorine.

Stannous chloride, or tin salt, occurs in commerce in a solid form as well as in solution. In a solid form it forms white, columnar crystals which are readily soluble in water and have an acrid, metallic taste. It being

poisonous when taken internally, eare should be used in handling it. The solution of tin-salt in water always shows a more or less milky turbidity.

Chloride of lime is a white or whitish powder, or in friable lumps, dry or but slightly damp, with a feeble odor of chlorine, and a disagreeable bitter and saline taste. Under eertain circumstances it may undergo decomposition on keeping, either with the evolution of oxygen or by conversion into a mixture of chloride and chlorate of ealcium. On exposure to the air it absorbs and eombines with carbonic acid and beeomes moist. It has an alkaline reaction, but finally bleaehes test-paper. When rubbed with water it is almost entirely dissolved, the lime remaining behind. This forms the chloride of lime solution which serves as a basis for the bleaching and decolorizing proeess, and for the preparation of the various bleaching-fluids.

Thus the well-known *eau de Javelle* is obtained by mixing a filtered solution of 1 part of ehloride of lime in 12 parts water with a solution of potassium carbonate (potash) (1 part potash in 4 parts water). The mixture is allowed to settle and is filtered.

Chloride of lime solution in the same manner decomposed by alum or aluminium sulphate gives *Wilson's bleaching-fluid;* and by sulphate of magnesium, *Ramsey's or Grouvelle's bleaching-fluid.* These bleaching-fluids are colorless, or of a faintly yellowish color. They are extensively used for bleaching textile fibres, fabrics, and wash-clothes, and serve also for removing fruit and red-wine stains from the latter.

A too vigorous action of the chlorine upon the textile fibre is counteracted by subsequent immersion of the

fabric in solution of sodium hyposulphite or aqua ammoniæ.

Chlorine-water. This is less frequently used than bleaching-fluid. It forms a clear, greenish-yellow liquid, possessing the suffocating odor and acrid, irritating taste of chlorine. It evaporates without leaving any residue, but separates crystals of chlorine hydrate when cooled to the freezing-point of water.

Acetic acid occurs in commerce in various degrees of purity and strength. For our purposes chemically pure acid can only be taken into consideration, and it should especially be free from empyreumatic substances. The degree of acidity is of minor consideration, since too strong an acid can be readily reduced by the addition of water.

Acetic acid is a colorless fluid of a peculiar pungent taste, and when applied to the human skin causes redness and swelling, followed by paleness of the part. Prolonged application is followed by vesication and desquamation of the cuticle. At the ordinary temperature acetic acid evaporates perceptibly; it boils at 244.4° F. Acetic acid neutralized with pure carbonate of soda and diluted with water should not be changed by potassium permanganate solution.

Tartaric acid crystallizes in colorless, oblique, rhombic prisms or tables, which are inodorous and have a strongly acid and disagreeable taste. They have the specific gravity 1.764, dissolve at 62.6° F. in 0.6 part of water, 2 parts of 85 per cent. alcohol, 3.6 parts of absolute alcohol, 23 parts of ether, and 250 parts of absolute ether; they are more soluble in the same liquids at the boiling temperature, and are likewise

soluble in methylic alcohol and in glycerin, but insoluble in chloroform and benzine. It is a complete substitute for the more expensive—

Citric acid, with which it is frequently mixed, and in many cases even sold as such. Hence, whenever citric acid is prescribed tartaric acid may be substituted for it.

Oxalic acid forms flat, oblique, rhombic prisms, which are colorless, transparent, not deliquescent, inodorous, of a strongly acid taste and reaction, and soluble in about 8 parts of water at ordinary temperature, and in nearly all proportions of boiling water. They dissolve in $2\frac{1}{2}$ parts of cold and 1.8 parts of boiling strong alcohol, and are but slightly soluble in ether. Oxalic acid is very poisonous. It is rather cheap, and as in some cases it serves as a complete substitute for tartaric and citric acids, it is very frequently used.

Acid oxalate, or binoxalate, of potassium, popularly called *salt of sorrel*, is a combination of oxalic acid with potassium carbonate. It occurs in commerce in large colorless crystals which dissolve with difficulty in water. Oxalic acid as well as acid oxalate of potassium is much used for removing stains.

Hydrochloric acid. This well-known acid should be entirely free from iron, and, hence, should not be colored red by sulphocyanide of potassium.

Ox-gall should never be used as furnished by abattoirs. In that state it forms a green, or brownish-green, viscid, transparent, or more frequently translucent fluid of a peculiar, disagreeable odor. It is best first to cleanse it, which is done by mixing it in a bottle with an equal part by weight of 90 per cent. alcohol. The mixture is occasionally agitated, then set aside, filtered, and

finally evaporated to a syrupy consistency, or to complete dryness. In this state ox-gall forms a clear solution in water and in 90 per cent. alcohol.

The *tools* used for removing stains consist of tampions, sponges, large and small brushes, etc. The principal requisites, however, are experience, a light hand, and skill.

We now pass to the actual practical part, and commence with the description of the removal of

Dust-stains. The best means for this purpose are thorough beating and brushing. Old, dried-in stains in fabrics of wool, silk, satin, etc., are brushed over with a little yolk of egg mixed with alcohol, which is allowed to dry and then scraped off. Any adhering yolk of egg is finally removed by means of a clean linen rag and warm water.

Stains of unknown derivation in plain or dyed cotton goods are first treated with a very weak, lukewarm solution of soap, to each quart of which a teaspoonful of water of ammonia has been added. Washing is effected with a sponge or tampion dipped into the fluid. The fabric is finally washed in water.

It may here be remarked that before attempting the removal of stains, an experiment should in all cases be made on a portion of the fabric where, if a change in the color should take place, it would be least noticed.

For cleaning *woollen goods*, especially when colored, prepare a mixture of 20 parts ox-gall, 40 parts borax, 200 parts water of ammonia, and 500 parts alcohol. When solution is complete, add 30 parts glycerin and the yolk of 2 eggs.

Wash the fabric in the boiling solution, using a wooden

spoon for handling it. Then rinse it in clean warm water and dry it in the air, but *not in the sun.*

Silk, satin, etc., are treated with a solution of 40 parts borax, and 10 parts soap in 70 parts dilute alcohol, and 30 parts ether. Add to the solution the yolks of 2 eggs and 10 parts carbonate of magnesia. Thoroughly shake the mixture before use and apply it to the stains. Then wash in lukewarm water, rinse in cold water, and dry at a moderate heat. Smooth with a moderately warm iron. Any adhering particles of magnesia are removed with a brush.

Grease-stains, fresh as well as old, are best removed by dry or chemical cleansing. However, when this is not possible, wet the fabric, with the exception of silk, and after placing several thicknesses of blotting-paper under the stained portions, rub with a tampion and a sponge dipped in benzol or oil of turpentine. When the stain has disappeared from the surface, place a piece of blotting-paper upon it and pass a hot flat-iron several times over it. The entire fabric is finally washed in warm soap-water, to which water of ammonia has been added, or, still better, in a warm decoction of soaproot or of quillaia-bark.

For the same purpose the so-called *benzol-magnesia,* first proposed by Boettger, may be highly recommended. It possesses the advantage that it can be used everywhere without causing the disagreeable circles, rings, etc., which, with the use of benzol, can only be prevented by making a second ring with water, so that the benzol cannot spread out any further.

Benzol-magnesia is prepared by mixing calcined magnesia with sufficient benzol to form a soft, friable mass.

In this state it is put in a wide-mouthed glass bottle well stoppered, and kept for use. Its employment is very simple. It is spread quite thickly over the stains and rubbed well to and fro with the tip of the finger. The small lumps of earthy matter thus formed are brushed off, and more benzol-magnesia is laid on and left until the benzol has evaporated entirely, when the adhering particles of magnesia are brushed off. Materials that will bear washing are then cleansed with water; on silks, alcohol or benzol should be used instead. The process may be applied to textile fabrics of every description, except those containing very much wool, to which the magnesia adheres very tenaciously. It may also be used for stains, old or new, on all sorts of fancy woods, ivory, parchment, etc., without risk of injury. Ordinary writing-ink is not affected by it, but letter-press quickly dissolves, owing to the absorption of the fatty matter in the ink.

Gelatinized benzol may be used in the same manner, it being in many cases preferable to benzol-magnesia. It is prepared by dissolving in a quart bottle 120 parts of soap in 180 parts of hot water and adding 30 parts of water of ammonia. Then add sufficient water to fill the bottle three-quarters full, next sufficient benzol to fill it entirely, and shake.

Of this solution, mix 1 teaspoonful in a half-pint bottle with some benzol, and, after mixing, fill the bottle with benzol, shaking constantly. With this gelatine stains of all sorts can be removed without risk of injury to even the most delicate colors. However, if, on account of the employment of benzol, the formation of circles, rings, etc., is feared, scatter upon the place,

while still wet, plaster of Paris or lycopodium, which after drying is brushed off.

In many cases, especially when the grease-stains are fresh, the damage may be remedied by the use of water of ammonia or weak soda solution, and subsequent washing. From silk fabrics grease-stains are removed with benzol-magnesia or gelatinized benzol; ether-magnesia, which is prepared in a similar manner as benzol-magnesia, being, however, preferable for the purpose.

Ether-magnesia is prepared by mixing calcined magnesia with sufficient ether to form a thin paste, which is spread over the stains. After the evaporation of the ether the magnesia spot is brushed off and finally rubbed with a piece of soft white bread.

Oil-paint and varnish-stains are first treated with pure oil of turpentine, which experience has proved most suitable for the purpose, it being surpassed only by chloroform. The latter is, moreover, an excellent solvent for old stains, so that their removal with benzol-magnesia is readily effected.

Stains of resin, tar, or wagon-grease. These and similar stains are removed from white goods by moistening the fabric, rubbing the stain with a sponge dipped in oil of turpentine, and, after placing blotting-paper beneath and on top of the grease-spot, several times passing a hot iron over it. The entire fabric is finally washed in warm soap-water. Colored cotton or woollen fabrics are moistened, the stains thoroughly soaped, and, after allowing the soap to act for a few minutes, washed alternately with oil of turpentine and water.

If the stains are not removed by this operation, make a mixture of yolk of egg and oil of turpentine, spread

it over the stain, allow it to dry, then scrape it off, and finally wash thoroughly in hot water.

As a final means, the fabric may be washed in water to which some hydrochloric acid has been added, and thoroughly rinsed in soft water.

Articles of silk, satin, etc., are moistened, and the stains rubbed with a sponge dipped in a mixture of ether and chloroform. When the stain has disappeared scatter bole (pipe-clay) upon the place, cover with blotting-paper, and pass a hot iron several times over it.

If the stain has not disappeared, mix yolk of egg with chloroform, spread the mixture over the stain, allow it to dry, then scrape off, and treat as previously described.

Stearin and wax-stains are carefully removed as much as possible with a knife. Then place a wet linen rag beneath and blotting-paper on top of the stain and pass a warm flat-iron over it.

If the stain is inaccessible with the flat-iron, treat it with chloroform, which will surely remove it.

Fruit-stains disappear from linen goods (table-cloths, napkins, handkerchiefs, etc.) by rinsing in eau de Javelle or another bleaching-fluid, or in weak solution of chloride of lime, which must, however, be perfectly clear, and to which some vinegar may be added. When the fabric is clean, it is thoroughly rinsed in running water and best drawn through a solution of sodium hyposulphite or of soda.

White cotton goods may be treated in a similar manner. Fruit-stains frequently disappear by simply washing in soap-water to which some borax or water of ammonia has been added.

Woollen goods are either immersed in a weak solution of sulphurous acid, or subjected to the action of a solution of hyposulphite of soda for about one hour, and then brought into a solution of tartaric acid, where they remain until the stain has disappeared. They are finally washed in water to which some bicarbonate of soda has been added.

For colored goods the above-mentioned methods cannot be used, it being first necessary to make an experiment to see whether the colors will stand chlorine or sulphurous acid, *i. e.*, whether they are likely to be changed or perhaps entirely destroyed by the action of these agents. If the colors will stand soap, the stains will disappear by washing in tepid soap solution, or in a decoction of soap-root or quillaia bark, otherwise they will have to be covered by dyeing.

Stains of red wine, cherries, whortleberries, etc., in white goods are treated in the same manner as fruit-stains.

Stains of wine may be quickly and easily removed from linen by dipping the stained parts into boiling milk, the milk to be kept boiling until the stain disappears.

Milk- and coffee-stains. Apply a mixture of yolk of egg and glycerin, then wash in warm water, and, while still moist, iron the fabrics upon the wrong side with a flat-iron which should not be too hot.

As a rule, milk- and coffee-stains are difficult to remove, especially from light-colored and finely finished goods. From woollen and mixed fabrics they are taken out by moistening them with a mixture of 1 part glycerin, 9 parts water, and $\frac{1}{2}$ part water of ammonia. This mixture is applied to the goods by means of a

brush and allowed to remain for 12 hours, occasionally renewing the moistening. After this the stained pieces are pressed between cloth and then rubbed with a clean rag. Drying, and if possible a little steaming, are generally sufficient to thoroughly remove the stains.

Stains on silk garments which are dyed with delicate colors, or finely finished, are more difficult to remove. In this case 5 parts of glycerin are mixed with 5 parts of water, and ¼ part of water of ammonia added. Before using this mixture it should be tried on some part of the garments where it will not be noticed, in order to see if the mixture will change the color. If such is the case, no ammonia should be added. If, on the contrary, no change takes place, or if, after drying, the original color is restored, the above mixture is applied with a soft brush, allowing it to remain on the stains for 6 to 8 hours, and is then rubbed with a clean cloth. The remaining dry substance is then carefully taken off by means of a knife. The damaged places are now brushed over with clean water, pressed between cloths, and dried. If the stain is not then removed, rubbing with dry bread will cause it to disappear. To restore the finish, a thin solution of gum arabic—in many cases beer is preferred—is brushed on, then dried, and carefully ironed. By the careful manipulation above mentioned stains will be successfully removed.

Soup-stains, as well as smaller grease-stains in general, are removed by washing in hot water to which some soda, or borax, or water of ammonia has been added.

Stains on cotton goods need only be rubbed with rectified oil of turpentine or benzol. The surplus of the solvent is then removed with blotting-paper and the

fabric washed in clean soap-water, whereby the stains will be successfully removed.

Silk fabrics are treated in the same manner, ether or chloroform being, however, preferred to benzol.

Stains of beer, wine, punch, sugar, gelatine, glue, etc. Comparatively speaking, these stains are very readily removed, simple washing in clean, tepid soap-water being in most cases sufficient, If necessary, the fabric may be washed in eau de Javelle or another bleaching-fluid, or in perfectly clear solution of chloride of lime to which some vinegar has been added. It is finally thoroughly rinsed in water, or, still better, in a solution of hyposulphite of soda.

Grass-stains are removed from linen goods by washing in boiling water or by treating with a bleaching-fluid.

Another plan is to wash the stained places in clean, cold soft water, without soap, before the garment is otherwise wet.

Grass-stains on cotton, woollen, or silk fabrics are removed by moistening them with chloride of tin and immediately washing in a large quantity of water.

Stains from green nuts, as well as so-called tannin-stains, are repeatedly washed with water and alcohol, then treated with dilute chlorine-water, pure, perfectly clear chloride of lime solution acidulated with vinegar, or one of the various bleaching-fluids, and finally washed in much water.

Acid stains, when fresh, disappear by moistening them with water of ammonia or soda solution, the original color being in almost all cases restored by the subsequent application of chloroform.

Old stains resist all reagents and have to be re-dyed.

Nitric acid stains. These stains are generally of a yellow color, and, when fresh, can be removed from brown or black woollen garments by moistening them for a while with concentrated solution of permanganate of potash and rinsing with water. Old stains are brushed over with nitrate of silver solution, whereby they acquire a black color.

Stains of wine-vinegar, sour wine, etc., are removed by neutralizing the acid with water of ammonia, soda, or a similar agent.

Lye- and lime-stains disappear from linen fabrics by washing. From cotton, woollen, and silk goods the stains are removed by carefully applying to them, drop by drop, any acid (with the exception of sulphuric and tartaric acids), until they have disappeared, and then thoroughly washing. Hydrochloric acid free from iron is best suited for the purpose.

Urine-stains are removed by washing with alcohol or dilute nitric acid solution and freshening up the place where the stain has been with chloroform.

Ink- and iron-mould stains. As regards ink-stains, a distinction has to be made between those caused by aniline ink and those by nut-gall ink.

In the first case the stains—provided they are not on silk fabrics—can generally be removed by washing in soap-water, in a bleaching fluid, or in spirit of wine acidulated with vinegar. Tartaric acid—the more concentrated the older the spots are—may also be used for white goods. To stains on colored cottons and woollens, and on silks, cautiously apply dilute tartaric acid.

The removal of stains due to nut-gall ink is more

difficult. If not too old, stains on linen goods sometimes yield by laying the fabric in a bleaching fluid or chloride of lime solution, allowing it to remain for some time.

These stains also frequently disappear by treating them with a concentrated solution of oxalic, tartaric, or hydrochloric acid.

Many housewives have a peculiar method of treating ink and iron-mould stains with oxalic acid. They scatter upon the moistened stain pulverized oxalic acid and rub it into the tissue with the bright handle of a key or a piece of bright iron; or they stretch the stained portion of the fabric over a heated bright tin pot or tin plate and rub in the powdered oxalic acid, without knowing that the reducing action loosens the coherence of the fibre with the ferrous oxide and makes the latter more accessible to the dissolving action of the oxalic acid. The action is the more effective the more intimately the stain is brought in contact with the heated metal.

To produce the best effect it is only necessary to scatter fine tin dust or tin shavings upon the stain previously moistened with hot oxalic acid solution. The stain disappears as if by magic.

Another method is as follows: Mix equal parts of cream of tartar and citric acid, powdered fine. This forms the salt of lemons as sold by druggists. Procure a hot dinner-plate, lay the part stained on the plate, and moisten with hot water; next rub in the above mentioned powder with the bowl of a spoon until the stain disappears; then rinse in clean water and dry.

The stain may also be washed in a solution of yellow prussiate of potash to which sulphuric acid has been

added, and the blue spot thereby formed removed by rinsing in potash solution. If, after this, a yellow stain should remain, it is removed with sulphuric acid.

Beschorner recommends the following process: Place the linen fabric in a mixture of 15 parts distilled water and 2 parts hydrochloric acid, allow it to remain in the mixture for half an hour, then wash thoroughly in clean water, and pour ammonium sulphide over the still moist stain; the latter operation should be conducted in the open air. After ten minutes, when the iron has been converted into ferrous sulphide, rinse the linen in clean water, pour a mixture of 1 part hydrochloric acid and 15 parts distilled water over it, and again rinse in clean water.

Fresh ink-stains on cotton or woollen goods are generally removed by allowing a drop of grease from a burning tallow candle to fall upon the stain, and washing in a concentrated solution of pyrophosphate of soda. The older the stain the more thoroughly it has to be washed.

For stains on fabrics dyed with fast colors, chloride of lime or tartaric acid may be used.

Old ink-stains are washed in dilute chloride of tin solution, and the fabric thoroughly rinsed in soft water.

From silk fabrics ink-stains, as a rule, cannot be removed, the only remedy being to re-dye the stained portions.

If the colors of the fabric permit, the stain may be moistened with strong vinegar, covered for some time with beechwood ash, and finally washed in strong soap-water.

Blood-stains may be entirely obliterated from almost any substance by laying a thick coating of common starch over the place. The starch is to be mixed as for laundry use, and laid on quite wet.

The free and early application of a weak solution of soda or potash, and the subsequent application of alum solution, are also recommended.

The following table, which is taken from the "MUSTER ZEITUNG," gives at a glance the best means of cleaning all kinds of fabrics from any stain whatever.

Kind of Stain.	From Linen.	From Colored Goods.		From Silks.
		Cotton.	Woollen.	
Sugar, glue, blood, and albumen.	Simple washing with water.			
Grease.	Soapsuds, alkaline lyes.	Lukewarm soapsuds.	Soapsuds, ammonia.	Benzine, ether, ammonia, potash, magnesia, chalk, yolk of egg.
Varnish and oil-paints.	Turpentine, or benzine, and soap.			Benzine, ether, soap; rub carefully.
Stearine.	Very strong alcohol, 95 per cent.			
Vegetable colors, red wine, fruit, red ink.	Sulphur vapors; warm chlorine water.	Wash out with warm soapsuds or ammonia water.		The same; rub gently and carefully.
Alizarine ink.	Tartaric acid; the older the stain, the stronger the solution.	Dilute tartaric acid if the stuff will bear it.		The same; with care.
Iron-rust and ink made of nut-galls.	Warm oxalic acid solution; dilute hydrochloric acid, then tin turnings.	Repeated washing with a solution of citric acid, if the colors will bear it.	The same; dilute hydrochloric acid if the wool is dyed naturally.	Nothing can be done; and all attempts only make it worse.
Lime, lye, or alkalies.	Simply wash with water.	Drop dilute nitric acid upon it. The stain previously moistened can be rubbed off with the finger.		
Tannin, green nut shells.	Eau de Javelle, warm chlorine water; concentrated solution of tartaric acid.	Alternate washing with water and with more or less dilute chlorine water, according to the colors.		
Coal tar, wagon grease.	Soap, oil of turpentine, alternating with a stream of water.	Rub with lard, then soap it well. After a time wash alternately with water and turpentine.		The same; but use benzine instead of turpentine, and the water must fall on it from some height.
Acids.	Red acid stains are destroyed by ammonia, followed by thorough washing with water. Brown stains of nitric acid are permanent.			

The preceding table and the receipts previously given, together with the directions which follow, afford a ready means of determining the proper method of procedure. Taking out grease and other spots from clothes is an application of chemistry which has a practical interest for everybody. It demands a certain acquaintance with solvents and reagents, even though the laws of chemical affinity on which their action depends may not be understood. The general principle is the applying to the spot of a substance which has a stronger affinity for the matter composing it than this has for cloth, and which will render it soluble in some liquid so that it can be washed out. At the same time it must be something that will not injure the texture of the fabric or change its color.

The following directions, taken from the "MONITEUR DE LA TEINTURE," deal especially with the garment dyer:—

Steam has the property of softening fatty matters and thus facilitating their removal by reagents.

Sulphuric acid may be employed in certain cases, especially to brighten and raise greens, reds, and yellows, but it must be diluted with at least 100 times its weight of water or more, according to the delicacy of the shades.

Hydrochloric acid is used with success for removing spots of ink and iron-mould upon a great number of colors which it does not sensibly affect.

Sulphurous acid is only used for bleaching undyed goods, straw hats, etc., and for removing fruit-stains upon white woollen and silk fabrics. The fumes of burning sulphur are also employed for this purpose, but the liquid acid (or a solution of the bisulphite—*not bisulphate*—of soda or magnesia) is safer.

Oxalic acid serves for removing spots of ink and iron, and the residues of mud-spots which do not yield to other cleansing agents. It may also be employed for destroying the stains of fruit and astringent juices, and stains of urine which have long been upon any tissue. Nevertheless it is best confined to undyed goods, as it attacks not only fugitive colors, but also certain of the lighter fast colors. The best method of applying it is to dissolve it in cold or lukewarm water, and to let a little of the solution remain upon the spot before rubbing it with the hands.

Citric acid serves to revive and raise certain colors, especially greens and yellows; it destroys the effect of alkalies or any bluish or crimson spots which appear upon scarlets. In its stead acetic acid may be employed.

Water of ammonia is the most energetic and useful agent employed for cleaning tissues and silk hats, and for quickly neutralizing the effects of acids. In the latter case it is often sufficient to expose the goods to the fumes of this alkali in order to remove such spots entirely. Ammonia gives a violet cast to all shades produced with cochineal, lac, the redwoods, or logwood, and all colors topped with cochineal. It does not deteriorate silks, but at elevated temperatures it perceptibly attacks woollens. It serves to restore the black upon silks damaged by damp.

Carbonate of soda (soda crystals) serves equally in most of the cases where ammonia is employed. It is good for hats affected by sweat. Soda and potash only serve for white goods, of linen, hemp, or cotton, because these alkalies attack colors and injure the tenacity and suppleness of woollens and silks. For the same reason

white soap only is to be recommended for cleaning white woollen tissues.

Mottled soaps serve for cleaning heavy stuffs of woollen or cotton, such as quilts. For such articles as do not require great suppleness or softness of feel, the action of the soap may be enhanced by the addition of a small quantity of potash.

Soft potash soaps may be usefully employed in solution together with gum arabic or other mucilaginous matters, for cleaning dyed goods and especially self-colored silks. This composition is preferable to white or marbled soaps, as it removes the spots better and attacks the colors much less.

Ox-gall has the property of dissolving the majority of fatty bodies without injuring either the color or the fibre. It may be used preferably to soap for cleansing woollens; but it should not be employed for cleansing stuffs of light and delicate colors which it may spoil by imparting to them a greenish-yellow or even a deep-green tint. It is also mixed with other matters such as oil of turpentine, alcohol, honey, yolk of egg, fuller's earth, etc., and in this state is used for cleaning silk.

Yolk of egg possesses nearly the same properties as ox-gall, but is much more expensive. It must be used as quickly as possible, for it loses its efficacy with keeping. It is sometimes mixed with an equal bulk of oil of turpentine.

III.

FINE WASHING.

UNDER this head the most approved and best methods of cheaply cleaning in a professional manner the different kinds of garments, etc., will be given.

For washing *white woollen goods*, it is best to use boiling-hot soapsuds compounded with borax, the articles acquiring by this treatment a looseness and dazzling whiteness which they frequently do not possess when new.

For the removal of greasy dirt, sweat, etc., borax is of so little value that its application would be mere waste. Soap-lye alone is better, but the preference must be given to soap-lye along with ammonia. This mixture works wonders by quickly dissolving dirt from particular parts of underclothing which are hard to cleanse. It raises and revives even bright colors, and is altogether excellent.

In washing good woollens the white should be separated from the colored. For the latter there should be prepared a lye of about 3 quarts of soft water and 2 ozs. of best soft-soap, the quantities being of course modified according to judgment and the dirtiness of the articles. The soap is dissolved over the fire, and the lye, properly stirred, is divided between two vessels, to one of which is added a teaspoonful of ammonia for each quart of lye. The woollens having to be entered at a heat which the hand cannot bear, the fabrics must, consequently be

turned and pressed with smooth wooden stirrers. They are then pressed out as far as possible and transferred to the second lye containing no ammonia, and which by this time has become so cool that the articles can be pressed by hand, but no twisting or wringing must take place. They are then pressed between three or four soft dry towels, till the latter no longer become wet. The articles are then pulled into proper shape, under-clothing, for instance, being pulled somewhat in width, this being especially required for the sleeves, which have a tendency to become long and narrow.

For white woollen goods there is added, instead of ammonia, a teaspoonful of powdered borax to each quart of soap-lye, and the operation is otherwise conducted exactly as above described. If the second lye is too soapy, it may be diluted with a little hot water.

It is of the utmost importance that the soap-lye in which the woollens are washed should always be hot; this is readily effected by adding the first to the second, and replacing the first by fresh soap-lye, adding, as the case may be, ammonia or borax.

If shrinking is to be entirely avoided, the drying must be accelerated by repeatedly pressing the woollens between soft cloths. In no case should woollens be let dry in the sun, as that makes them dry and hard. They are best dried in a moderate current of air, and in cold weather in a warm place, not too near the stove.

Very suitable for washing woollen as well as mixed goods is a decoction of soap-root or of quillaia bark, neither of them attacking even the most delicate colors.

Flannels are soaked over-night in lukewarm water and washed in water of not above 122° F. An addition

of borax instead of soda promotes the cleansing process. When the articles have been freed from the worst dirt, they are several times rinsed in warm water, and finally washed in warm water to which one tablespoonful of wheat-flour (or simply wheat-bran) per quart has been added. They are then washed in cold soft water.

Flannels not too dirty may be cleansed by treating with lukewarm soap solution to which, besides borax, some water of ammonia has been added, or by simply washing in a decoction of soap-root.

The original whiteness of *woollen and mixed goods which have turned yellow* can only be restored by bleaching. Chloride of lime solution is not very suitable for this purpose, animal substances being with difficulty taken up by chlorine. Such articles must, therefore, be treated either with sulphurous acid solution or with gaseous sulphurous acid. Sulphurous acid solution can be procured in almost any drug-store. Place the articles in the solution, cover the vessel and allow them to remain in the fluid, with occasional stirring, until the desired effect has been produced.

The operation is still more simple by proceeding as follows: Place the washed articles while still wet in a solution of hyposulphite of soda and allow them to soak for a few hours. In the meanwhile prepare in another vessel a solution of hydrochloric acid free from iron, or still better of tartaric acid, and into this bring the articles, without wringing, from the first solution. The vessel containing the acid fluid must be well covered, as in consequence of the action of the acid upon the hypo-

sulphite, sulphurous acid is developed, which acts as a decolorant.

Bleaching with gaseous sulphurous acid requires certain contrivances, the simplest form of which consists of a tight box provided with two apertures, through one of which the articles to be bleached are introduced and through the other an iron dish containing burning sulphur. The apertures must of course be provided with well-fitting lids. The articles to be bleached must be covered with a cloth.

After bleaching by either of the above described methods, the articles must be washed, their whiteness being enhanced by adding some water of ammonia to the wash-water.

Notwithstanding bleaching, every white fabric shows a more or less yellowish cast and for that reason is generally blued. Now it is an undeniable fact that blue and yellow combine to form green ; hence all fabrics blued with a blue coloring-matter (indigo solution, ultramarine, etc.) always possess a greenish cast, which can only be removed by again passing them through a solution of a red coloring-matter.

It is therefore advisable to use, instead of a blue, a violet coloring-matter, various kinds of aniline blue with a reddish cast, and especially methyl-violet 4 R, being very suitable for the purpose.

Woollen shawls and borders with colored embroidery are washed in a similar manner in soap-water containing borax, or in a decoction of quillaia bark.

Garments of muslin de laine and similar fabrics have to be ripped apart before washing. For the latter purpose three wash-tubs standing alongside one another and

each provided with a washboard are required. The pieces are pressed and rubbed in succession against the washboards, and when they come from the last tub are perfectly clean. They are then rinsed, blued and starched, and brought into the drying-chamber, where they are stretched upon frames.

White curtains, laces, and embroideries. Before wetting these articles baste a strip of muslin along the scalloped sides. Heat the water in a tub, which holds about 20 pairs of curtains, to about 140° or 149° F. and add 2 lbs. of soda and 2 lbs. of chloride of lime. Before adding the latter stir it to a stiff paste with cold water, then scald with hot water and use the clear solution only. After manipulating the articles allow them to remain in the fluid for 20 minutes, then lift them out and rinse in warm water. If more articles are to be bleached, add to the same fluid 1 lb. of soda and 1 lb. of chloride of lime. Rinse the articles once more in water and prepare another bath of about 100° F. to which add 1 pint of sulphuric acid. Into this bath bring the articles and manipulate them for a few minutes until they are of uniform whiteness; then rinse them twice in warm water, adding, when rinsing the second time, 1 lb. of soda. Now lift the articles out and set them aside. During cleansing and bleaching prepare a tub full of boiling water, and add to the latter sufficient soap solution. In this boiling soap-bath the articles are washed until clean, when they are rinsed twice in warm water and blued. They are then placed by means of the above-mentioned strips of muslin upon large extension-frames provided with pins pointing upward and, after

stretching them uniformly by drawing out the frames, dried.

Another method of washing curtains is as follows: Shake every curtain, or hang the curtains on a line and brush them down with a soft brush. Prepare a soaking liquid by melting a small quantity of borax in warm water; soak for an hour or two, then squeeze between the hands to remove the superfluous water. Take a good quality of soap, chip it into hot water, and stir until all the soap is melted and a fine lather produced. By this time the water will be moderately warm. Immerse the curtains in this, passing them repeatedly through the lathered water or working them up and down. Rubbing should be avoided; when absolutely necessary, do it gently and without a brush. Squeeze out the soapy water, and rinse in plenty of soft warm water. Wring carefully. Curtains should be dried quickly. They may be spread to dry on clean grass, otherwise they are better for being stretched and pinned to wooden frames while drying.

It is advisable to use cooked starch for curtains. Use good starch; mix it thoroughly in warm water which should be made to boil for fifteen or twenty minutes. While cooling add a very little indigo-blue. This is only to be used for pure white curtains. The starch should be decidedly thick. Draw the curtains through it, squeeze out gently, and dry rapidly.

Many persons prefer tinted curtains to pure white ones. If they are to be colored, do not put any blue in the starch, but for preparing the latter use water that has been slightly tinted with coffee (for ecru curtains), tea for a more decided hue, or saffron (for yellow tint).

A decoction of logwood may be used for giving the curtains a delicate pink hue.

Satin, silk ribbons, brocade, and silk damask are best cleansed by the dry or chemical process. They may, however, also be cleansed by rubbing them either with yolk of egg or Venice soap, washing in tepid water, rinsing in cold water, and drying. Now dissolve good gum tragacanth in equal parts of wine-vinegar and spring water, and strain the solution through a cloth; it should not be too thick. Dip the fabric in this solution so that it is uniformly moistened, then squeeze out the gum water, and by means of a brush spread the fabric upon a smooth board and let it dry quickly in the sun, or near a warm stove. Silk ribbons, however, should be ironed dry.

Another method of washing silk ribbons is as follows: Wash the ribbons with ox-gall and soap in warm water, and impart lustre to them with honey and white of egg, or draw them several times through a solution of gum tragacanth and sugar. Then let them dry and finally iron them between two sheets of paper. The iron should not be too hot.

To clean black silk. Add to ox-gall sufficient boiling water to make it warm, and with a clean sponge rub the silk well on both sides; squeeze it well out, and proceed in like manner. Rinse it in clean water, and change the water until perfectly clean. Dry it in the air and pin it out on a table; but first dip the sponge in glue water and rub it on the wrong side; then dry before a fire.

To clean white silk. White silk is best cleaned by dissolving curd soap in water as hot as the hand can bear,

and passing the silk through and through, handling it gently and rubbing any spots till they disappear. The silk should then be rinsed in lukewarm water and stretched by pins to dry.

To renovate black silk. According to the French process, a weak solution of coffee-water is used. Do not wet the silk too much, and restore the lustre by careful rubbing with a soft handkerchief. White silks can be cleansed with a dry powder composed of fine starch and a little laundry blue. Rub over the tissue, and dust thoroughly. Bread-crumbs or chalk should be used for pink or cream-colored silks. Silks may be ironed on the wrong side with a moderately hot iron, or on the right side (to give a fine lustre) if well protected by two folds of slightly dampened muslin.

Silk and silver galloons are placed in curdled milk for 24 hours. Then convert a piece of good soap into shavings, stir them in 2 quarts of soft water, add a proportionate quantity of honey and fresh ox-gall, and beat the whole for some time. If it becomes too thick, add water so that a thinly-fluid paste is formed. Allow this to stand for 12 hours, and then apply it to the wet galloons. Then wrap a moist cloth around a mangle roller, around the cloth the galloons, and around the latter another moist cloth. The galloons are then mangled, they being occasionally moistened with water, and several times brushed over with the above-mentioned paste. Next soak gum arabic in water until completely dissolved, add an equal quantity of sugar, and when this is completely dissolved, and the solution has become clear, immerse the galloons in it; then mangle them smooth between two cloths and hang them up to dry.

To wash *gold galloons* place them overnight in urine, or a poor quality of white wine, and then proceed in the same manner as with silver galloons.

If the galloons, laces, etc., are worn so that the white ground shows through, they may be restored as follows: Extract 50 parts by weight of shellac, 2 of dragon's blood, and 2 of turmeric root with strong alcohol, and decant the ruby-red extract. Apply the extract by means of a camel's-hair brush to the articles to be restored, and then pass over them at a height of several inches a hot flat-iron, so that the galloons only feel the heat.

Gold embroideries are treated in the same manner.

Silver laces or embroideries are cleansed with a powder prepared as follows: Alabaster is strongly calcined, and while hot placed in whiskey. A white powder is obtained, which is dried over the flame of a spirit-lamp and placed in a linen bag. The lace is then dusted over with the powder and brushed with a velvet brush. Instead of the alabaster powder, Vienna lime may be used.

Another method of cleaning gold and silver lace is as follows: Sew the lace in a clean linen cloth, boil it in 1 quart of soft water and $\frac{1}{4}$ lb. of soap, and wash it in cold water. If tarnished, apply a little warm spirits of wine to the tarnished spots. Gold lace may also be cleaned by the application of a weak solution of cyanide of potassium.

Silk fabrics and tissues are best washed in a decoction of soap-root or quillaia bark, or in a decoction of tea, or in strong bran-water in which some alum has been dissolved. Great care has to be observed in the use of

soap, the latter exerting in many cases an injurious effect upon the colors. Instead of soap, it is preferable to use a dilute solution of water of ammonia (1 part of water of ammonia to 10 parts of water), and to thoroughly manipulate the silk in it without the assistance of heat. This treatment can be especially recommended for black silk, which thereby becomes like new; colored silks should first be experimented with to see whether the ammonia affects or changes the colors. Lustre is imparted to washed silk by applying, before ironing, beer or a thin solution of gum tragacanth or gum arabic. Good results are also obtained with a solution of 5 ozs. of mastic in 200 ozs. of spirits of wine. Place the silk upon an ironing-board, and with a sponge moisten a portion of the fabric with the mastic solution. Then iron this portion dry with a moderately hot iron. On account of the resin, this work presents some difficulties, which may, however be overcome, by skill and experience. By uniformly continuing the operation, the fabric acquires a lustre which is not injured by rain.

To wash laces. Cover an ordinary wine-bottle with fine flannel, stitching it firmly round the bottle. Tack one end of the lace to the flannel, then roll it very smoothly round the bottle and tack down the other end, then cover with a piece of very fine flannel or muslin. Now rub it gently with strong soap-water, and if the lace is very much discolored or dirty, fill the bottle with hot water and place it in a kettle or saucepan of suds and boil it for a few minutes. Then place the bottle under a tap of running water to rinse out the soap. Make some starch about as thick as arrow-root for an invalid, and melt in it a piece of white wax and a little loaf-

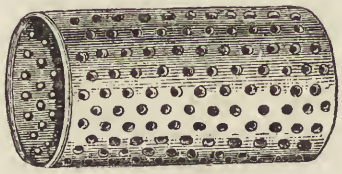
sugar. Plunge the bottle two or three times into this and squeeze out the superfluous starch with the hands. Then dip the bottle in cold water, remove the outer covering from the lace, fill the bottle with hot water and stand it in the sun to dry. When nearly dry take it carefully off the bottle, pick it out with the fingers and then lay it in a cool place to dry thoroughly.

Another method is as follows: First rip off the lace, carefully pick out the loose bits of thread and roll the lace very smoothly and securely round a clean black bottle previously covered with old white linen. Tack each end of the lace with a needle and thread to keep it smooth, and be careful in wrapping not to crumple or fold in any of the scallops or pearlings. After it is on the bottle take some of the best sweet oil and with a clean sponge wet the lace thoroughly to the inmost folds. Have ready in a wash-kettle a strong cold lather of clear water and Castile soap. Fill the bottle with cold water to prevent its bursting, cork it well, and stand it upright in the suds, with a string round the neck secured to the ears or handle of the kettle, to prevent its knocking about and breaking while over the fire. Let it boil in the suds for an hour or more till the lace is clean and white all through. Drain off the suds and dry it on the bottle in the sun. When dry remove the lace from the bottle and roll it round a wide ribbon-block, or lay it in long folds; place it within a sheet of smooth white paper, and press it in a large book for a few days.

Instead of a bottle, it is preferable to use a perforated cylinder of white porcelain (Fig. 4), which is covered with fine muslin. Then wrap the lace round the muslin and cover it with muslin. Boil the whole in soapsuds

to which some borax has been added, rinse in clean water, starch, and dry, the latter being rapidly effected in consequence of the many perforations of the cylinder. When dry remove the lace from the cylinder.

Fig. 4.



To wash white silk crape. Soak over night in a solution of good white soap in milk, then sponge without rubbing, and lay it in a solution of soap in water for 12 hours; and finally place it between two damp cloths in a basket. Put some sulphur in an iron-pot and place the latter in a barrel or tall vessel, covering the latter with a cloth folded four times. Place the basket containing the crape over the sulphur, which is now ignited and allowed to burn some time. The crape is then taken out, stretched evenly over a board covered with cloth, and pressed down upon it with a sponge dipped in white boiled starch. Bubbles of starch, if formed, may be removed with a wet sponge.

To wash white gauze. Place the gauze between two cloths, together with some fine shavings of Venetian or other good soap, put all in a tin dish, and pour lukewarm water over it. Place a cloth folded double on top, load it down with a weight, and, when the water has become cold, pour it off and replace it by lukewarm

water, repeating this operation several times. Now let it stand overnight under the pressure of the weight, then rinse the gauze several times with lukewarm water. The further treatment and sulphuring are the same as given for white silk crape.

Fine muslins, batists, etc., are first soaked in warm water. Then boil 550 ozs. of soap, 15 ozs. of alum, and 32 ozs. of tartar to a mass, and after removing the scum, form the mass into pieces or balls. With one of these pieces rub the fabric without disarranging the threads; then squeeze out and repeat the operation several times. Now rinse several times in clean water, taking care that no particles of soap remain adhering to the fabric, otherwise yellow stains will be formed. Finally, pour a few drops of indigotine solution in clean water, rinse the fabric in it, and dry it in the shade.

Veils require different treatment according to whether they are white or colored. *White veils* are washed in blood-warm soap-water, gently wrung out, rinsed in cold well-water, blued, starched, beaten half-dry between the hands, and finally hung up to dry thoroughly.

Black and colored veils are cleansed by rinsing in ox-gall and water to remove the dirt, afterwards in pure water to remove the gall, and lastly in a little gum water to stiffen and crisp them. They are clapped half-dry between the hands and finally hung up to dry thoroughly.

For cleansing and renovating colored, and especially black veils, some washers only use whiskey, whereby they impart a characteristic lustre to the tissues. They are then stiffened with gum-water, clapped between the hands, and finally ironed between two moist linen cloths.

Skimmed milk and water, with a little bit of glue in it, made scalding-hot, is excellent to restore rusty Italian crape. If clapped and pulled dry like muslin, it will look as good as new; or brush the veil till all the dust is removed, then fold it lengthwise, and roll it smoothly and tightly on a roller. Steam it until it is thoroughly dampened, and dry on the roller.

Calicoes, as well as other cotton goods and fabrics, are washed in a decoction of soap-root or quillaia bark. Wheat-bran is also frequently used, the process being as follows: Heat water in a wash-boiler so hot that the hand can scarcely be held in it. Then add of wheat-bran the eighth part of the weight of the articles to be washed, stir the mixture for five minutes over the fire then introduce the articles, stir them frequently with a wooden stirrer, and let the bran-water boil. Then allow it to cool, thoroughly wash the articles in the bran-water while still warm, rinse in clean soft water, and dry at the ordinary temperature.

Nankeen is more difficult to wash. It is well known how easily it may be spoilt; this can, however, be prevented by the following treatment: Take, for every nankeen article to be washed, about 1 oz. of green tea, boil it in the necessary quantity of water, pour the decoction while boiling-hot through a clean linen cloth upon the nankeen, and allow it to remain in it until cold. Then take the nankeen out and dry it, without wringing out, in the shade.

For washing *nankeen garments* use soap-water, not too hot. Then boil the garments, rinse them, and hang them up inside out, and without wringing, in a

shady place to dry. Iron them on the wrong side with an iron not too hot.

The mode of cleansing *taffeta* varies according to whether the fabric is white or colored. *White taffeta* is soaked in soft water and then washed with wheat-bran and Venice or another good soap. It is then rinsed, sulphured, and finally stiffened with gum tragacanth, fleabane seed, and indigo solution, then mangled between two cloths and lightly brushed.

By another method white taffeta is washed three times in a solution of 5 ozs. of good white soap in 2 gallons of soft water prepared by boiling and cooled off to lukewarm.

Black taffeta is washed in a like solution of soap in water which has stood overnight, then stiffened with gum arabic and fleabane seed, and mangled and ironed.

Another method of washing black taffeta, as well as other black-silk fabrics, is by rubbing the fabric with a sponge dipped in beer, mint-water, or whiskey, then mangling dry between two cloths, and finally ironing on the wrong side.

Embroidered fabrics, or muslin, linen, as well as cloths, caps, etc., woven with gold, require very careful handling. They should be soaked in cold water, strictly avoiding all rubbing and squeezing, to prevent a disarrangement of the threads. When this has been done, make suds of lukewarm water and Castile soap, place the embroideries in it, and carefully squeeze them out; then place them in fresh water, and after four hours squeeze them out and let them dry; then sew muslin around the edges of each piece and stretch in a frame for finishing.

To clean velvets, velveteens, and plush. Silk and cotton velvets, velveteens, and plush, when stained or gener-

ally soiled through wear and exposure, may be either cleaned or dyed. Slightly soiled fabrics should be brushed to get rid of dust, and then sponged with a weak solution of borax or with benzine. When very much soiled they will have to be dipped in a bath of benzine, weakened by the addition of a little water. The drying should not be too rapid, but thorough. The pile must be brushed quickly the right way, but previous to brushing the pile, the back of the fabric must be stiffened; for this purpose prepare a strong solution of gum arabic in water. On taking the velvet or plush out of the bath, dry it and then brush the back over with the gum solution. This stiffens the fabric and prevents the pile from getting loose. When dry, turn over the velvet on the right side and brush it smartly, so that the pile lies upright and in the proper direction. If this precaution of stiffening the back is not observed, the brushing will only do harm. If stiffened, the pile remains firm, and can be easily brushed up. In the case of figured and parti-colored velvets this precaution should never be omitted, or the design will be spoiled. Velvet dress-trimmings that are faded and greasy may be made to appear like new material by judiciously following the above directions.

To restore the pile of velvet, hold the wrong side of the velvet over boiling water, and the pile will be gradually raised.

In the following, a concise statement regarding the cleansing of various fabrics and renovation of the attacked colors is given :—*

* "Deutsche Musterzeitung."

Soiled or stained woollen goods, such as cashmere, merino, etc., are cleansed as follows: Add to a clean water-bath 2 spoonfuls of tincture of soap (*spiritus saponatus*) and 1 spoonful of ox-gall; quickly wash the fabric in the bath once, or, if necessary, twice; rinse in cold water, and finally, to prevent the fading of the color, draw it through a clean, very weak alum bath; place the cleansed fabric between two linen cloths, and after wringing out secure it by pins to a frame and dry it in the shade.

White satin and, as a rule, nearly all *silk fabrics*, are treated as follows: Mix in the cold way 1 part white soap, 2 parts white honey, and 4 parts whiskey; gently heat the mixture to the boiling-point and apply the very hot liquid with a soft brush to the satin to be cleaned. The latter should for this purpose be spread upon a marble plate which has previously been carefully cleansed by washing with whiskey. Rinse the satin several times in cold water, without wringing, until the water runs off clear; then place the satin between two white linen cloths, allowing it to remain, according to the season, for one hour or less, when, while still damp, it is ironed with a hot iron. By this treatment the satin reacquires its entire freshness and pristine lustre.

In place of hard white soda soap, soft potash soap may be employed. In this case prepare a mixture of 2 parts of tincture of soap and 1 part of white honey, and apply the hot mixture uniformly to the fabric. If too thick, dilute the mass with a little whiskey. By the use of a hot iron, as above described, the labor of securing the satin by pins to a frame and of drying is saved.

All slight stains disappear by the above described method of cleansing. It is, however, absolutely necessary that the brush, wash-water, and smoothing-iron should be perfectly clean, and that the mixture, the object of which is to destroy the stains, should always be hot.

To cleanse colored silk fabrics, for instance, a *necktie*, or an *embroidered silk shawl*, proceed as follows; Dissolve 1 oz. of gall-soap in a corresponding quantity of boiling-water. When solution is complete and the soap-water has acquired a temperature of 104° F., immerse the shawl in the fluid, move it to and fro in it, or, if it has the necessary stability, wash it between the hands like cotton goods, and then rinse it several times in warm water. If the shawl contains colors which might fade, rinse it in water acidulated with 4 per cent. sulphuric acid. More acid must not be used, especially with fiery yellow, scarlet, crimson, and chestnut-brown colors; other brown, bronze, and fawn colors require no addition of acid.

However, in all cases the cleansing must be done quickly, so that the soap does not act too long upon the colors, because it attacks the constituents of crimson, rose-color, red, and yellow, as well as the various shades of these colors. The action of the soap upon the colors is therefore decreased by working rapidly, then rinsing in the acid bath, squeezing out the fabric, without wringing, spreading it upon clean stout linen, rolling it together with the linen and wringing. After this operation spread the shawl, etc., upon a frame, dry it in the drying-chamber and calender it cold.

Silks dyed blue, or the various shades of violet, are cleansed from stains with a syrupy solution of Castile soap, to which some white potash has been added. Wash the fabric in this solution, rinse in water, wring out between stout linen cloths, and dip in a weak decoction of isinglass, to which has been added a very small quantity of potash. To freshen up the color, brush the back of the fabric with a sponge, again wring between stout linen cloths, and finally dry upon a frame.

The above described method, however, cannot be employed for French blue, which is dyed with Paris blue, it being decomposed by alkalies. The same holds good as regards the well-known chemical blue.

Olive-green silks are scoured in the same manner as the preceding colors, without, however, dipping in an acid bath. To freshen up the color, add to the last wash-water some acetate or sulphate of copper.

To clean and wash black silk proceed as follows: Dilute ox-gall with 6 or 7 parts boiling water. With a clean sponge dipped in this fluid rub both sides of the silk, allow it to drain off between the hands, then rinse in soft water until the latter runs off clear, squeeze out the fabric and dry it upon a frame. Then brush the back with a sponge dipped in a weak decoction of isinglass. By finally drying in the drying-chamber the fabric acquires its original appearance.

If the black silk has *yellow stains* similar to rust-stains, immerse it in a water-bath slightly acidulated with sulphuric acid, move it to and fro in it and knead it with the hands for five minutes. It is then rinsed in cold water, and its original lustre restored by careful drying and ironing.

Carpets are best cleansed by the dry or chemical process.

To freshen up carpets on the floor (without taking them up) cover them with an inch thick layer of sawdust, moistened with soda solution, so that it can be strewed without any of the fluid dripping off. Then pass an iron roller, similar to those used for garden walks, several times over the sawdust. The effect produced by this operation is that the solution contained in the sawdust is squeezed out by the weight of the roller, but after the passage of the latter is immediately reabsorbed by the sawdust, the whole operating, so to say, like a large sponge. The weight of the roller can be regulated according to the moisture of the sawdust, so that too strong a pressure which would force the fluid to the back of the carpet can be avoided. When the moistened sawdust is supposed to have acted sufficiently it is removed by a revolving brush similar to a carpet-sweeper.

The use of other sawdust saturated with clean water alone, rolling as above, and vigorous brushing, effect the removal of dirt and at the same time of the soda solution. The carpet is now clean, but its colors are not fresh. The colors previously changed by light and air have become still uglier by the soda solution, scarlet appearing violet-brown, etc.

The original brightness of the colors is soon restored, as far as possible, by treating the carpet with sawdust moistened with oxalic acid solution. The operation is finished with sawdust moistened with clean water.

To be sure, by these operations, which are rapidly executed, the upper side of the carpet is strongly moistened;

the solid basis-tissue, however, remains nearly dry, so that after the operation is finished the carpet dries rapidly in the air. Drying is still more rapidly effected by spreading, after the last moist treatment, dry cotton cloths over the carpet and passing the roller over them. The cloths then absorb the moisture.

The sawdust is from time to time washed in water, freed from water in a centrifugal, and prepared anew.

Smaller and ordinary carpets are first well beaten, brushed, and then manipulated wet with a brush. For this purpose bring one end of the carpet upon an oblique table, allowing the rest to remain rolled up in front of the table. Pour strong soda solution upon the portion on the table, scrub it with a stiff scrubbing-brush, working from the upper to the lower end of the table, and rinse by pouring on lukewarm water, brushing constantly. Soap-baths no longer suitable for washing garments may be advantageously utilized for washing ordinary carpets.

When the portion covering the table is finished, the carpet is drawn sideways and a fresh portion the size of the table is treated in the same manner, the operation being repeated until the entire breadth is finished. It is then rolled up and placed on the other side of the table, a fresh portion to be cleansed being at the same time placed on the table. The operation is thus continued until the entire carpet has been gone over. The table is then turned round so that its lower end faces the roll of carpet. The freshening up of the colors is then proceeded with by pouring a bath acidulated with hydrochloric or sulphuric acid upon the portion of the carpet upon the table, spreading the fluid out uniformly

by means of the brush, brushing thoroughly, and rinsing immediately. The operation is then continued in the same manner as washing until the entire carpet has been treated with the acid bath.

The results obtained by the above-described operations are very satisfactory, one workman only being required. The carpet thus cleansed is then hung upon a line to dry, which requires from 6 to 8 hours.

To cleanse and wash white sheepskins. Rub the skin-side with tallow or oil and then dry with the assistance of heat. Now wash in the ordinary manner with soap and water and dry; then wash with benzine. Treated in this manner the skin remains soft.

To cleanse white woollen blankets. Wash them, with the assistance of the washboard, in two good soap-baths containing a small quantity of soda; then rinse them in a soda-bath and hang them in the sulphuring chamber to bleach.

The latter consists of a chamber, the access to which is closed as hermetically as possible. In the floor paved with bricks is a box-like cavity which is filled with from 2 to 10 lbs. of pulverized sulphur. About 4 inches below the ceiling are placed wooden poles over which the blankets are hung. The ceiling is lined with smooth boards, and care should be taken not to use in the ceiling—and, if possible, in the construction of the entire chamber—iron nails or other metallic parts, as they may cause stains of rust or verdigris difficult to remove. In the ceiling is a valve, which can be opened from the outside, for the escape of the sulphur vapors when the bleaching process is finished.

The blankets being hung over the poles, the sulphur

in the cavity in the floor of the chamber is ignited with a hot iron and the cavity covered with a stone in such a manner as to leave a few small openings through which the vapors may escape. This is done to prevent the flame from blazing up and scorching the blankets. The door of the chamber is then closed and made as air-tight as possible.

The blankets are allowed to remain in the chamber for 12 to 24 hours. The door and the valve for the escape of the vapors are then opened and the blankets taken out. They are then turned for 5 to 10 minutes in a warm bath acidulated with sulphuric acid, next rinsed and dried.

After drying, the blankets are steamed by drawing them over the steam-box, and are finally carded.

IV.

BLEACHING AND DYEING OF STRAW HATS.

THE object of bleaching the straw for hats and the hats themselves is a two-fold one, viz: either to restore the original whiteness of soiled hats, or to make them more suitable for the reception of colors.

Hats not too much soiled may be cleansed by washing with a 5 per cent. solution of citric acid, using a small sponge for the purpose. Then rinse thoroughly in water and dry in the sun. The result is surprising. The following method also yields good results: Take good potash soap, separate it with dilute soda-lye and common salt, and add to it, while still soft, $\frac{1}{5}$ of its

weight of pulverized sulphite of soda. Then cut the soap into bars, dry it and put away for use.

The soap is employed as follows: Soak the articles to be bleached in water to which, for every 12 quarts, about 11 drachms of water of ammonia have been added. When the articles have been thoroughly soaked and adhering grease has been removed by this treatment, a portion of the above-mentioned soap is dissolved in 10 or 12 parts of water, and the actual washing effected in this solution. When the articles have thus been thoroughly treated, they are immersed in dilute hydrochloric acid (about 20 parts water to 1 part acid), so that they are thoroughly saturated. The vessel is then covered, and, after standing for one hour, the articles are taken out, thoroughly rinsed and dried.

The actual decoloration (bleaching) of straw, whether in a loose or braided state, is a difficult problem, requiring, besides much labor and pains, many years' experience.

Bleaching may be effected by chlorine as well as by sulphurous acid; natural bleaching will not answer, because the coloring-matters in the straw are not sufficiently destroyed thereby, and, moreover, the straw by remaining for some time upon the bleaching ground loses strength. Neither can bleaching with chlorine alone be recommended. It exerts a vigorous bleaching effect, but having to be used rather strong, it makes the straw brittle and lustreless. An entirely favorable result is only obtained by bleaching with sulphur, eventually in connection with chlorine, which, however, must then be used very weak. But, first of all, it is necessary to free the articles of straw from substances which offer a

certain resistance to the bleaching process, such as coloring-matters, resins, wax, etc. For this purpose boil the articles in a solution of potash to which white soft-soap and water of ammonia have been added. Continue boiling for at least two or three hours, during which time the articles should be constantly covered by the fluid, and it is therefore necessary to replace the water lost by evaporation without interrupting the boiling.

The washing of the boiled articles is effected first in boiling-hot water, which is gradually succeeded by colder water. If it were attempted at once to wash the articles in cold water, many of the above-mentioned substances, which are only soluble in boiling or hot water, would be precipitated upon the fibre and the expected result thus prevented. Neither is it suitable to allow the straw to lie in the cleansing bath, because by slow cooling many of the above-mentioned substances are fixed on the fibre. The object of washing with boiling water, and then with water becoming gradually colder, is to detach and rinse off from the fibre the substances dissolved by boiling.

After washing allow the articles to drain off, and then bring them, while still moist, into the bleaching-fluid. For bleaching, as above mentioned, chlorine or sulphurous acid may be used. Some prefer the former, but many years' experience has proved the latter to be the best for the purpose. Decoloration is very rarely effected by means of gaseous chlorine, because special contrivances are required for the purpose, and, furthermore, the preparation of chlorine gas demands the services of a skilled person. Hence, a description of

the various manipulations with gaseous chlorine is omitted.

Wet bleaching with chlorine may be effected by two different methods: either by the use of a chloride of lime solution, or one of the bleaching-fluids mentioned on p. 38.

For bleaching with chloride of lime, a solution of it has first to be prepared. This is frequently effected by bringing a weighed quantity of chloride of lime into a wooden vessel lined with lead or provided with a thick coat of white-lead paint, stirring it with some water, crushing the lumps formed, and finally adding with constant stirring the necessary quantity of water. However, this is a very primitive mode of preparing

Fig. 5.

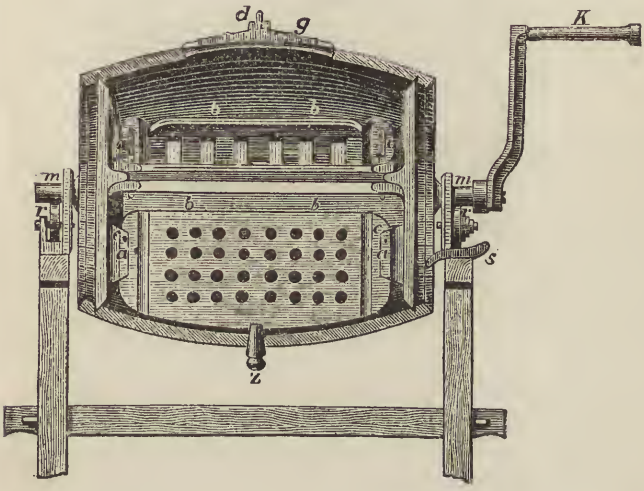
the solution, and cannot be recommended, because by the action of the carbonic acid of the atmosphere

progressive decomposition is induced, chlorine gas being developed, which exerts a disagreeable effect upon the respiratory organs.

It is, therefore, recommended to use for the solution of the chloride of lime a simple apparatus which does not permit the access of air, or at least prevents it to a great degree.

A stout barrel suffices for dissolving not too large quantities of chloride of lime. To the head and bottom of the barrel are screwed, as shown in Figs. 5 and 6,

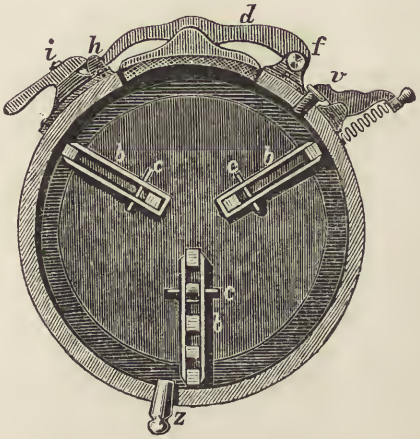
Fig. 6.



circular pieces of iron ending in short shafts, *m*, which run upon anti-friction rolls. To one of these shafts is secured a crank, *K*, and on the same side as the crank is an adjusting arrangement, *s*. The aperture closed by a bung, Z, or a stop-cock, serves for discharging the solution.

In the interior of the barrel, to the head and bottom, are fixed at equal distances from each other three pairs of wooden blocks, between which are inserted the three movable wings *b*. These wings are provided with holes, and secured by leaded pieces of iron. The oval aperture of the barrel is hermetically closed by an iron plate lined with lead and resting upon a rubber ring. An iron strap, *d*, Fig. 7, which is secured on one side by

Fig. 7.



an iron pin, *f*, and rests at *g* in a furcular elevation of the lid, can be firmly pressed down by a movable wedge, *i*. At *h* the strap *d* rests in another furcular elevation secured to the barrel.

To secure the wooden portions of the barrel against destruction, they should either receive several coats of white-lead paint, or, what is still better, be lined with lead.

The advantages of such a vessel for dissolving the chloride of lime consist in that it can be hermetically closed; that solution progresses rapidly; and that it can be thoroughly cleansed after removing the wings. The only disadvantage of this and all other similar contrivances is that the solution cannot be drawn off clear, any residues of chloride of lime depositing in the deepest place of the apparatus. Since, however, the solution has to be perfectly clear for use, it must be filtered through close linen.

As a rule, 10 to 12 quarts of solution are made from 2 lbs. of chloride of lime.

The vessels in which the bleaching of straw articles is to be effected must be either of wood lined with lead, or painted with white lead or asphalt lacquer, or of stoneware. The vessel is filled as far as necessary with perfectly clear chloride of lime solution; the straw articles, previously prepared by boiling with potash, are then, while still moist, introduced and allowed to remain several hours, being frequently stirred. The principal requisite is that the articles be entirely covered by the fluid. After a few hours add some acetic acid or a corresponding quantity of strong vinegar, whereby a more vigorous evolution of chlorine gas is produced.

By heating the vessel containing the chloride of lime solution to about 104° F., the process of decoloration is accelerated.

When sufficiently bleached the articles are taken from the vessel, and rinsed first in running water and then in a solution of hyposulphite of soda.

When the *hypochlorites* (*bleaching-fluids*) are used the straw articles are allowed to remain in them until the

desired degree of decoloration has been effected. With hypochlorites the action of chlorine upon the vegetable fibre is entirely excluded, their effect being solely due to the liberation of ozonized oxygen. Such solutions possess the advantage of always remaining neutral and of not inducing, as frequently happens in bleaching with chloride of lime, a residue of hydrochloric acid in the bleached articles, which causes them gradually to become brittle. Washing need not be so carefully done as when bleaching with chloride of lime.

Like decoloration with chlorine, *bleaching with sulphurous acid* is also executed according to various methods.

For bleaching with *sulphurous acid in a gaseous state* special arrangements (bleaching-chambers) must be provided. A simple apparatus suitable for a small number of straw hats has been described on p. 60. The hats, as well as all other articles which are to be bleached with sulphurous acid in a gaseous state, have to be wrapped in a close tissue.

With the use of the *aqueous solution of sulphurous acid* the process is the same as in bleaching with chloride of lime solution, the only difference being that the addition of acids is omitted. The hats remain immersed in the fluid for a few hours, care being taken to keep the vessel containing the fluid well closed during that time. The process may in this case also be accelerated by heating the bleaching-fluid.

The process of bleaching is still more simplified by the use of a salt containing sulphurous acid, such as sulphite or hyposulphite of sodium, etc. Dissolve a sufficient quantity of such a salt in water and immerse

the previously cleansed straw articles, while still moist, in the solution, allowing them to remain in it for several hours. In the meanwhile, prepare in another vessel a dilute solution of hydrochloric acid free from iron (one of tartaric acid is preferable), bring the hats into the solution, and after covering the vessel with a lid allow them to stand until they have acquired the proper degree of whiteness.

If the hats and other articles of straw are properly prepared by treatment with soap, potash, and water of ammonia, they will come from the bleaching-fluid in a faultless state. They are then rinsed in running water, and to increase still further their whiteness they may be slightly blued with methyl-violet of a reddish tinge.

For six hats of the ordinary kind, $3\frac{1}{2}$ ozs. of hyposulphite of sodium and $2\frac{3}{4}$ to 3 ozs. of pure hydrochloric acid free from iron are generally required. Exact quantities by weight cannot be given, since the variety of straw, thickness of the braid, etc., have to be considered.

With the exception of black, tar colors are now generally used for dyeing straw.

In *dyeing black*, many difficulties are met with, since, notwithstanding the greatest care in preparing the straw, places are generally found which do not absorb the color in the required degree.

Experience has shown that this evil may be overcome as follows: Add a solution of gluten which has been allowed to stand for 24 hours to a lye of soda or potash, and when a thorough mixture has been effected, filter the fluid through a linen cloth; then immerse the straw in the clear liquid for 12 hours. The straw is thus freed from grease. When dry immerse it in a

solution of nitrate, sulphate, or acetate of iron, allowing it to remain for 12 hours, when it is dried. Now prepare a decoction of logwood, add a decoction of sumac or galls, or solution of tannin, and immerse the straw in the hot fluid. A slight addition of bichromate of potash improves the tone of the dye. Lustre is produced with gum arabic or gelatine. When this has been done, rub each hat with a woollen cloth and a trace of oil, and finally, to remove the oil, with a clean cloth.

According to another method, the hats freed from grease are brought into a dye-bath containing for 25 hats 4 lbs. of logwood, 26 ozs. of galls, and 5 ozs. of turmeric, and allowed to boil for two hours. They are then taken from the bath, rinsed, and immersed in a solution of nitrate of iron at 4° Bé. until they have acquired the desired shade of black.

Another method is as follows: The hats are first steeped in soda at 5° Bé. at a temperature of 122° F. for three hours, rinsed, and soaked overnight in a decoction of sumac containing $2\frac{1}{4}$ lbs. sumac for every 5 hats. In the morning take out, drain, and lay the hats separately to air for six hours; rinse and dye at 144° F., with $2\frac{1}{4}$ lbs. logwood per 11 lbs. of hats, till the shade is reached. Lift, drain, dip singly in a lukewarm fluid containing $8\frac{3}{4}$ ozs. glue per 17 pints of water, dry, and rub with a hard brush.

Silver-gray is produced by boiling the bleached straw hats in a solution of 4 lbs. of pure alum free from iron and $3\frac{1}{2}$ ozs. of tartaric acid for two hours, and then adding sufficient cochineal and indigo-carmine, besides a small quantity of sulphuric acid, to produce the desired shade.

It may here be remarked that hats to be dyed must previously be freed from grease by immersion in an alkaline lye, and, for light colors, bleached.

Chestnut-brown (for 25 straw hats). Boil 26½ ozs. of sanders-wood, 35¼ ozs. of turmeric, and 3½ ozs. of logwood in water for half an hour; then strain the liquor and gently boil the hats in it for two hours. The dye-bath must be of such a capacity that the hats are not pressed one against the other. The hats are then thoroughly rinsed and allowed to stand overnight in a bath of nitrate of iron at 4° Bé. They are finally once more steeped in a bath of sanders-wood and then in one of logwood.

When dry, lustre is imparted by brushing the hats with a hard brush.

A beautiful *medium brown*, suitable only for finer straw-hats (120 hats), is obtained as follows: Immerse the hats in a solution of tin salt, allowing them to remain overnight, and the next morning wash them thoroughly in water; then heat a boilerful of clean water to boiling and add 4 lbs. of fustic, 2 lbs. of madder, and 3 ozs. of archil. In this bath boil the hats for about two hours, and after adding 3 lbs. of catechu and 3 lbs. of green vitriol, boil for two hours more. None of the hats should project from the bath, otherwise they become black. After dyeing, cool at once and then draw the hats through warm water, whereby they acquire a beautiful brown.

The cheapest brown on straw-hats (for 12 hats) is obtained as follows: Steep the hats in a solution of 1 lb. of soda, allowing them to remain until they appear dark yellow. Dissolve in another vessel 4½ ozs. of green vit-

riol, immerse the hats in the solution, allow them to remain for 10 to 15 minutes, moving them frequently, and rinse in warm water. By allowing the hats to remain in the bath for a longer time, and using a larger quantity of green vitriol, they become darker.

Havana-brown (for 22 lbs. of hats). Soak the hats in a solution of $4\frac{1}{2}$ to 6 lbs. of alum, then dye in a bath of 13 ozs. of sanders-wood, 1 lb. of turmerie, $3\frac{1}{2}$ ozs. of sumac, and $12\frac{1}{4}$ ozs. of logwood, and rinse.

Catechu-brown (for 22 lbs. of hats). Boil with sulphate of alumina $34\frac{1}{2}$ ozs., bisulphate of soda $17\frac{1}{2}$ ozs., sulphuric acid $8\frac{3}{4}$ ozs. Add to the bath archil, indigo-carmine, and turmeric according to shade, and boil.

Maroon. Clean the straw by boiling with a solution of carbonate of soda, and then steep in a bath of logwood for two hours. To give a bluish tint, add some blue-stone to the bath; if too much of the latter is used, the straw will have a greenish hue. This color is not fast, and is employed only for its cheapness.

Violet (for 25 hats). Dissolve in a kettle of sufficient capacity 4 lbs. of alum, 1 lb. each of argol and tin salt, and boil the hats in the solution for two hours. Then add logwood decoction, with a little alum and indigo-carmine, according to the shade desired.

Yellow. To produce the yellow shade which is frequently in such demand, give the hats a bath containing a little picric acid and acidulated with a little sulphuric acid, and let them dry on the block. For a gloss, rinse in gum water or water in which gelatine has been soaked.

The most beautiful colors on straw, however, are obtained with aniline colors, but, as previously mentioned,

the straw must first be freed from grease and bleached. It is then mordanted with a decoction of 7 ozs. of sumac, 35 ozs. of alum, and 17½ ozs. of tartar.

The process may be simplified by dyeing in an aniline color-bath containing tannin and fixing in a solution of tartar emetic.

Many aniline colors are taken up by the fibre without previous mordanting.

The aniline colors possess the advantage of being mostly soluble in water. Solution is best effected by pouring about 100 parts of boiling water over 1 part of aniline color and thoroughly stirring. The aqueous solutions being in time subject to decomposition, it is recommended to prepare only sufficient for present use, and, before dyeing, to filter them through a close cloth, since any undissolved particles of coloring-matter may readily cause stains.

With aniline colors all possible shades of color may be produced. Thus canarin yields fast yellow; metalline-yellow, very fine yellow shades; methyl-violet with new Victoria-green gives peafowl-green; whilst brilliant green, malachite-green, or new Victoria-green yields, with auramine- or metalline-yellow, any desired shades of yellow-green. Erythrine gives beautiful yellowish-red to bluish-rose colors, and, mixed with ponceau, beautiful fiery red tones.

V.

CLEANSING AND DYEING OF GLOVES.

In cleansing gloves, the kind of glove, whether so-called Suede, chamois, buckskin, or kid, has to be taken into consideration. The first three varieties may be cleansed by putting them on the hand or a glove-tree (a wooden hand) and rubbing them with bread-crumbs or a stiff brush dipped in a mixture of dried fuller's earth and powdered alum.

Usually, the gloves are laid in cold water for a few minutes and then washed in the ordinary manner in lukewarm soap-solution to which some water of ammonia has been added. When clean they are gently squeezed out between cloths without wringing. Instead of water, milk may be used, the treatment being the same as above described.

Suede gloves, after washing, are usually laid in spirits of wine for 24 hours, then hung up and dried in the shade, in the air.

A quite good method of cleansing is as follows: Place the gloves in a fluid composed of 2 parts of water of ammonia and 8 parts water for two days, then rinse in cold soft water and dry in the air. Since by this method of washing the gloves are not rubbed as is necessarily the case in washing with soap, the leather does not become rough, but preserves its original appearance.

Another method of *cleansing chamois, buckskin, and undressed kid gloves* is as follows: Wash them in luke-

warm soft water with a little Castile or curd soap, ox-gall, or bran-tea, then stretch them on wooden hands or pull them into shape without wringing. Next rub them with pipe-clay, yellow ochre, or umber, or a mixture of them in any required shade, made into paste with ale or beer; let them dry gradually, and, when about half-dry, rub them well so as to smooth them, and pull them into shape. When they are dry brush out the superfluous color, cover them with paper, and smooth them with a warm (not hot) iron.

Another method is as follows: Take out the grease-spots by rubbing them with magnesia or cream of tartar. Then lay the glove flat on a board, the bottom of a dish, or other unyielding surface; dip a piece of flannel in a lather made with curd soap and warm water, and rub the glove with it until all the dirt is out, turning it about so as to clean it all over. Then rinse first in warm water and next in cold. Dry in the sun or before the fire. All gloves are better and more shapely if dried on glove-trees or wooden hands.

Kid gloves are best cleansed, without the use of water, as follows: Put the gloves on your hands and wash them in spirits of turpentine until they are quite clean, rubbing them exactly as if washing your hands. When finished hang them in a current of air to dry and to take off the smell of turpentine.

The use of *gelatinized benzol* may also be highly recommended, but in this case the gloves must be stretched on wooden hands.

Another mixture for cleansing kid gloves is as follows: Eau de Javelle 135 parts, water of ammonia 8, powdered

soap 200, water 150. Make into a soft paste and use with a piece of flannel.

Another way is to use a strong solution of pure soap in hot milk, beaten up with the yolk of an egg to a pint of the solution. Put the glove on the hand and rub it gently with the paste, to which a little ether may be added, then carefully lay aside to dry. White gloves are not discolored by this treatment, and the leather will thereby be made clean and soft as when new.

The best mode of cleansing kid gloves is, however, with benzol. Stretch the gloves over wooden hands and rub them with a soft brush dipped in benzol until they are perfectly clean.

Another plan is as follows: Put the gloves together with a sufficient quantity of pure benzol in a large stoppered vessel, and shake the whole occasionally with alternate rest. If, on removing the gloves, there remain any spots, rub them out with a soft cloth moistened with ether or benzol. Dry the gloves by exposure to the air, and then place them smoothly between glass plates at the temperature of boiling-water until the last traces of benzol are expelled. They may then be folded and pressed between paper with a warm (not hot) iron.

Dyeing kid gloves. The gloves are smoothly stretched over wooden hands, and the color applied with a brush.

Black. After washing the gloves in alcohol, apply three times a decoction of logwood by means of a brush, allowing between each application ten minutes for drying. Then dip the gloves in a solution of green vitriol and brush with warm water. Should the color not prove sufficiently dark, a decoction of fustic or quercitron may be added to the logwood decoction. Instead of

green vitriol, nitrate of iron may be used. As the leather begins to dry, it is rubbed over with a little olive oil and talc powder, and pressed between flannel. The treatment with oil and talc powder is repeated, and the glove then allowed to dry on a wooden hand. The inside of the glove must not get black, consequently none of the coloring-matter should reach it.

The bluish tint so greatly admired in black gloves is obtained by washing the dyed article with water of ammonia.

Brown. The dye-bath is made up of varying quantities of decoctions of fustic, logwood, and Brazilwood, according to the shade desired. For darkening, a small quantity of green vitriol is employed.

Morocco-red is produced by brushing the glove with a decoction of cochineal to which a little tin salt and oxalic acid are added. If a darker tint is desired, add a small quantity of logwood decoction.

Gray is obtained by brushing with decoction of sumac and subsequent treatment with weak solution of green vitriol. An addition of logwood and yellow Brazilwood to the decoction of sumac produces a greenish-gray tint.

If the seams are to remain white, cover them with flour-paste mixed with a small quantity of grease.

The use of aniline colors for dyeing kid gloves is, however, far more simple and cheaper than the previously described methods.

There are at present very few colors which cannot be produced with the assistance of aniline colors, and, with the exception of very special shades, it may be asserted that leather can be dyed even in the most difficult colors.

However, not all aniline colors can be used for dyeing leather, it having been shown that many of them which are suitable for silk and wool exert a destructive influence upon leather.

For dyeing with aniline colors the gloves are smoothly stretched over wooden hands and first treated with a mordant; tannin, sumac, potassium chromate, and especially ammoniacal salts being best adapted for the purpose. The mordant, as well as the solution of coloring-matter, is applied with a brush or a sponge.

Red. According to the intensity of shade desired, which may be increased by the addition of small quantities of picric acid, dissolve pure water-soluble fuchsine in more or less water at from 78° to 86° F. Without previously mordanting the gloves, apply the solution at the above-mentioned temperature with a brush. With leather free from alum a perfectly uniform color is obtained which resists subsequent washing and exposure to the air.

Violet. Water-soluble aniline-violet alone is suitable for the purpose. Mix the solution with a small quantity of sulphate of aluminium, apply it like fuchsine, and rinse thoroughly. By the addition of blue or red, more bluish or reddish shades are obtained. Iodine-violet aniline colors yield the most beautiful shades; however, they resist for a short time only the action of light and air.

Blue. By pouring water of 86° F. over a pure, intense blue, endeavor to hit a degree of dilution at which a quite pale color is produced, and obtain darker shades by repeated applications. According to the variety of aniline-blue employed, mordanting the leather with

ammoniacal salts, alum, etc., may be recommended; the most suitable mordant, however, has to be ascertained by an experiment on a small scale. As a rule, a small quantity of bichromate of potassium suffices. The various kinds of alkaline-blue are successfully used, and yield very beautiful tones, especially on delicate, fine leather. To combine the color more readily with the leather, a small quantity of sulphuric acid may be added to the alkaline-blue; wash thoroughly after dyeing, and dry at not too high a temperature.

Green. The most suitable coloring-matter for this purpose is iodine-green. It may be used in paste and in powder, but the aqueous solution should be made as concentrated as possible. After brushing the glove with solution of sulphate of ammonium, apply the solution of coloring-matter at about 95° F., its soaking through being prevented by rapid operating. Picric acid should not be added to the solution of coloring-matter, but be applied to the leather before and after dyeing with iodine-green.

Yellow and brown. Experiments with aniline-yellow and brown have shown that picric acid is frequently to be preferred to the first, and dye-woods to the latter. Picric acid produces, without mordant, the same colors on leather as on silk and wool, and is very resistant to exterior influences. The color produced is modified to green by aniline-blue, and to red by crimson. The solution to be used should be very dilute and, to prevent soaking through, its temperature should not exceed 68° F.

Vesuvine, nigrosine, flavine, and similar aniline colors occurring in commerce are, according to their quality,

partially suitable and partially unsuitable for dyeing leather, so that general directions for their use cannot be given.

If, for the production of special shades, it is desired to mix colors, it must be done by the subsequent application of the pure coloring-matter to the leather.

VI.

DYEING OF FEATHERS.

Treatment in general. For all colors, except black and a few light colors, acid coloring-matters should, if possible, be used. Feathers dyed with these colors require, after being once or twice rinsed, to be drawn through a final rinsing bath acidulated with sulphuric acid, after which they are dried.

With ostrich feathers or large fancy feathers, the addition of coloring-matter is best effected by placing the articles in a sieve, or a willow-ware basket, since if they remained in the kettle they would break and tear in consequence of the necessary rapid handling, and besides would spot. The dissolved coloring-matter is added to the dye-bath, stirred, and the sieve or basket containing the feathers is placed in it.

For smaller fancy articles, such as chicken feathers and small wings, the addition of the coloring-matter is effected as follows: Bring the dissolved coloring-matter into a copper pan which holds 1 to 3 quarts and is provided with a long handle. Fill the pan with dye-bath or water and quickly plunge it, whilst constantly stir-

ring the feathers, into the kettle, emptying it on the bottom. A better, but more troublesome, method is as follows: Pour one-third or one-half of the dye-bath through a sieve into a kettle, so that the feathers remain behind; then add the coloring-matter, stir thoroughly, and return the whole, with constant stirring of the feathers, to the kettle. In this manner a very uniform and rapid distribution of the coloring-matter is effected.

The dyeing of fancy feathers differs in several respects from that of ostrich feathers.

The portions of birds, such as the goose, duck, kingfisher, penguin, pelican, etc., used in the manufacture of ornamental feathers, require for dark colors a greater affinity for the coloring-matters then they naturally possess. This is produced by the addition of sulphate of sodium (Glauber's salt) to the acidulated dye-bath, bisulphite of sodium being thereby formed, in consequence of which the fibre is more disintegrated and absorbs the coloring-matter more uniformly and to a greater degree.

Moreover, the feathers of the above-mentioned birds require greater heat, and may gently boil for $\frac{1}{4}$ or $\frac{1}{2}$ hour. But this cannot be done with articles containing portions of flesh, sinews, or skin, since they would dissolve and the articles fall to pieces. For skins, birds, heads, wings, tails, etc., the heat employed should also not exceed 167° F. In such cases the advantage of greater heat must be replaced by the greater strength of the bath.

Ostrich feathers are tied together by the lower ends of the quills in bundles of from 3 to 5 and 30 to 40 of such bundles strung together.

Dyeing Ostrich Feathers.

1. *Cleansing.* *a. Large feathers.* The feathers are soaked in a strong solution of Castile soap at 100° F., for one hour, or, still better, overnight, and then washed upon a washboard for 10 minutes. They are then brought into a weak soda-bath of the above-mentioned temperature and treated in the same manner. The entire manipulation is then repeated with fresh baths, when the feathers are thoroughly rinsed, drawn through a bath acidulated with sulphuric acid, and again rinsed.

b. Feathers in bulk. For 10 lbs. of ostrich feathers prepare a bath of 5 lbs. of crystallized soda dissolved in 50 quarts of water, and add a small quantity of water of ammonia. Heat the bath to 100° F., introduce the feathers, and allow them to remain for 4 to 10 hours. Cover the vessel with a lid fitting in it, so that the feathers remain completely submerged. Then wash the feathers piece by piece upon a washboard, rubbing them quite strongly. Then treat them in a second bath of 7 lbs. of crystallized soda and a little water of ammonia, though they need not remain in this bath as long as in the first. After again washing, the feathers are several times rinsed in cold water and then in warm water, drawn through a lukewarm bath acidulated with sulphuric acid, and again rinsed.

2. *Decolorizing.* The feathers cleansed in the above-described manner are laid flat in a bath of 50 per cent. peroxide of hydrogen, 3 per cent. water of ammonia, and 47 per cent. water heated to 100° F. The water of ammonia is added after the bath has acquired the above-indicated temperature. A glass or stoneware

vessel should be used for the bath. Work the feathers thoroughly in the bath, let them rest a moment, and work again. Then allow them to rest ½ hour, and work once more.

The bath should be protected from the light, and, while resting, the feathers must remain submerged. This is effected by placing a lid fitting in the vessel upon the feathers and loading it with a stone.

When the bath is perceptibly exhausted, *i. e.* when the bleaching process no longer progresses, the feathers are taken out and the treatment above described is repeated with a fresh bath. The originally gray or black feathers will finally appear white. They are then taken out, rinsed in several waters, and finally drawn through a bath quite strongly acidulated with sulphuric acid. They are then again rinsed, and have now the ground required for all light colors. If they are to be used white, they are slightly blued.

3. *Freeing from grease.* After cleansing the feathers according to the directions given under 1 *b*, they are brought into a bath which, for 10 lbs. of black ostrich feathers, is prepared as follows: Pour into a stoneware vessel of 100 quarts capacity 75 quarts of cold water, then add the solution of 10 lbs of chromate of potassium, and finally 5 lbs. of pure sulphuric acid of 66°. After stirring thoroughly, lay the feathers flat in the bath, turn them over, and cover the vessel. They are then turned over every hour until the natural color is uniformly stripped off and the feathers show a light color.

Care must be taken not to allow the feathers to remain in the bath longer than necessary for the removal of the natural color, and also not to keep the bath too

hot. In both cases the feathers are attacked and very easily become entirely worthless. The heat should not exceed 89° F. The feathers are now rinsed in two cold and several warm baths. The warm rinsing baths being used for the purpose of more rapidly removing the potassium, the feathers are left in them for some time. When the chromate of potassium has been completely removed, the feathers are worked in an oxalic acid bath for ¼ hour and rinsed. They are then worked in a bath of 2 lbs. of Castile soap, and rinsed in several warm baths. The feathers are now sufficiently prepared for the uniform reception of all medium and dark colors. Gray ostrich feathers require only half the quantity of chromate of potassium and sulphuric acid.

4. *White.* In case the white of the feathers cleansed, according to directions given under 1 *a*, is disfigured by natural brown spots and points, they are brought into a bath of 100° F. to which from 10 to 20 per cent. of peroxide of hydrogen has been added. They are taken out after half an hour or an hour and brought into a bath of 3 per cent. bisulphide of potassium heated to 110° F., where they remain for half an hour, when they are taken out and brought into a bath acidulated with sulphuric acid. They are then rinsed and drawn through a cold bath to which a small quantity of aniline-violet, (6 B) dissolved in alcohol, or marine-blue has been added.

It may be remarked that the more yellowish the white appears, the more of a reddish hue the blue to be used should have, otherwise a greenish tinge is readily produced.

5. *Dyeing black.* For 11 lbs. of thoroughly washed ostrich feathers, prepare a mordanting bath as follows: Fill a kettle holding about 150 quarts three-quarters full with water, and heat the latter to the boiling-point. Then add 11 lbs. of logwood and $7\frac{7}{10}$ lbs. of fustic, both dye-woods tied in a bag so as to leave room for expansion. Now boil briskly for one hour, then take the bags containing the dye-woods from the kettle, and add 23 ozs. of ground white argol, $17\frac{1}{2}$ ozs. of green vitriol, 14 ozs. of blue vitriol, and $10\frac{1}{2}$ ozs. of chromate of potassium. Stir until all is dissolved and the bath has boiled for a short time. Then reduce the temperature of the bath by the addition of water to 145° F., and place the feathers flat in it. Now, while constantly working and handling the feathers, raise the temperature of the bath to 190° F., then remove the fire entirely and cover the kettle, which is done by placing a smaller lid in the kettle upon the feathers and a larger one upon the edge of the kettle. The latter, to prevent cooling as much as possible, is covered with sacks. After once more working the feathers in the evening, they are left in the bath overnight. The next morning the feathers are hung in rows over a rod and allowed to cool one hour. They are then rinsed in several waters until the rinsing water appears clear.

Now prepare the following dye-bath: After freeing the kettle, by washing with clean water, from the remainder of mordant, fill it three-quarters full with water and bring the latter to the boiling-point. Then bring into the kettle $16\frac{1}{2}$ lbs. of logwood tied in a bag so as to leave room for expansion, and boil briskly for one hour. Then take out the dye-wood, cool the bath

to 145° F., and place the feathers flat in it. Heat the bath to 194° F., whilst constantly moving and handling the feathers. Next remove the fire, cover the kettle, and let it stand from 12 to 24 hours—overnight will do. Then take the feathers out, but do *not* rinse them.

Now repeat the operations of mordanting and dyeing as above described with baths of the same nature; the dye-bath previously used may, however, be employed as a mordanting bath, the entire mordant with the exception of logwood being added.

The feathers are then rinsed and one after another washed on a washboard in two weak, lukewarm soda-baths, next in a bath of 5 lbs. of good, white soap, and then again in two weak, lukewarm soda-baths.

The feathers are now chlorinated, the chlorine solution consisting of the clear solution of 4 lbs. of crystallized soda and 2 lbs. of chloride of lime.

The process of chlorinating requires special attention; it is best to perform it in the open air where there is plenty of light and an abundance of water. But as these cannot always be had, an example of executing the process in the dye-room itself is here given.

Place alongside the rinsing-tub another tub so that as much light as possible falls upon it from above. Now fill this tub with water of 122° F., so that the feathers can be freely moved in it. Then add about one-quarter of the above-mentioned chlorinating solution, stir well, and introduce the feathers. In consequence of the rapid manipulation, the bath is soon exhausted, and a sample of the feathers is occasionally placed in the water-bath standing alongside the tub containing the chlorinating-fluid. As long as the sample held in the

water shows a coppery, bronzed black, too much coloring-matter is present, and more chlorinating solution has to be added. The feathers are finished when the sample held in the water finally shows a beautiful, deep black.

The feathers are then taken out and rinsed in four to six cold water-baths. The more they are rinsed and the longer they remain in the water-baths, the more chlorine is withdrawn and the more beautiful the black appears.

6. *Bronze.* *a. Green.* The feathers dyed black according to the directions given under 5 are brought into a bath of 100° F. to which, for every 11 lbs. of feathers, a solution of 7 ozs. I^{a} diamond-fuchsine in large crystals has been added. After heating the bath to 167° F., manipulate the feathers in it until they show a beautiful, lustrous green-bronze. Then take them out and rinse.

b. Olive. Treat as above with a dye-bath consisting of $3\frac{1}{2}$ ozs. of I^{a} diamond-fuchsine and $2\frac{1}{2}$ ozs. of extra superfine aniline-violet 6 B.

c. Gold. Treat as above with a dye-bath consisting of $1\frac{3}{4}$ ozs. of I^{a} diamond-fuchsine and $5\frac{1}{4}$ ozs. of extra superfine aniline-violet 6 B.

7. *Other colors, including fashionable colors.* *a. Cream, ivory.* Naturally white or thoroughly decolorized feathers are dyed in a "hand-heat" bath to which a very small quantity of dissolved pale yellow has been added. Final shading according to sample is effected with a very small quantity of orange.

It may here be remarked that all vessels of stoneware or copper must be thoroughly cleansed, especially when used for light colors.

b. Rose, Venus. Dye the pure white feathers yellowish with a very weak solution of eosin in a neutral bath of 167° F. If the sample is bluish, dye bluish with cosin. Final shading according to sample may be effected with pale yellow.

c. Salmon. Dye with solution of eosin and pale yellow in a neutral bath of 167° F. Shade according to sample with both coloring-matters.

d. Paille, maize, bamboo. Dye the white feathers in a bath to which sulphuric acid, azo-yellow, and a little orange have been added, heating up to 190° F. For bamboo add a little more orange than for maize. Final shading is effected with the above-mentioned dye-stuffs according to sample.

To all acid dye-baths only so much sulphuric and tartaric acids should be added that a small excess is perceptible to the taste.

e. Ciel, azure, pale blue. Manipulate for a quarter of a hour the cleansed white feathers in a bath to which a weak solution of extra superfine, water-soluble pale blue has been added, heating up to 190° F. Then take out the feathers and add to the dye-bath sufficient sulphuric acid diluted with cold water to give it a slightly acid taste. Then replace the feathers, handle them for some time, and, if necessary, add coloring-matter until the sample-color has been obtained.

f. Butter, bouton d'or, mandarin, coq roche. The feathers decolorized, or eventually freed from grease, are brought into a bath of 145° F. to which some sulphuric acid, azo-yellow, and a little orange have been added. Handle thoroughly and effect final shading with the above-mentioned coloring-matters.

For *bouton d'or* a little blue may also be employed; for *mandarin* quite a considerable quantity of orange; and for *coq roche* much orange and some ponceau. The bath is heated to 200° F.

g. Parme, heliotrope, prune. The feathers are dyed in a bath acidulated with sulphuric acid and heated to 145° F. with acid violet R and acid violet 6 B. According to whether the sample is clearer or duller, final shading may also be effected with acid fuchsine, fast red, ponceau, orange, and, on the other hand, with pensée lake and indigo-carmine. Heat to 200° F.

h. Gold, old gold. White feathers are dyed, according to sample, in an acidulated bath at 145° F. with azo-yellow, orange, and pensée lake; for the latter, indigo-carmine may be substituted.

j. Gray. For the paler shades, white feathers are taken, and for the darker, feathers freed from fat. They are dyed with aniline-gray, extra superfine, and sulphuric acid at 200° F. Shade according to sample, with very small additions of fast brown, orange, azo-yellow, etc.

k. Coquilicot, cardinal. Dye the feathers, either white or freed from fat, according to sample, with sulphuric acid, some saccharic acid, ponceau 3 R, and genuine red at 200° F.

l. Garnet. Treat like the preceding, but, according to sample, use for yellow tones red coloring-matters with a yellow tinge such as orange, ponceau with pensée lake, or indigo-carmine; and for blue tones, coloring-matters with a bluish tinge, such as fast red, acid fuchsine; also acid violet, or marine-blue.

m. Beige, tobacco, Siam, and intervening shades. Feathers freed from fat may be used. Heat and acidity

of the bath as usual. Dye with azo-yellow, orange, and pensée lake. For the final shading fast brown, as well as fast red, ponceau or indigo-carmine may be used as required.

n. Chartreuse—pale yellow-green. Dye white feathers, according to sample, in a bath heated to 200° F. with sulphuric acid, azo-green, and acid green.

o. Cresson—dull yellow-green. Dye in the ordinary acidulated bath with azo-yellow, acid green, and aniline-gray, extra superfine, as well as eventually with some orange. Heat to 200° F. Shade, according to sample, if necessary, with pensée lake or indigo-carmine.

p. Olive. Dye with azo-yellow, orange, and acid green in the acidulated bath at 200° F. Shade, if required, with pensée lake, indigo-carmine, and also fast brown. Feathers freed from fat may be used.

q. Vesuve, Etna—dull, fiery tones. Dye, according to sample, white feathers, or feathers freed from fat, in the ordinary bath with sulphuric acid, ponceau, orange, and eventually azo-yellow, as well as for bluing, with pensée lake, indigo-carmine, or acid violet. Much red and yellow coloring-matters give a deep, fiery tone.

r. Vieux-rose belongs to the so-called distemper colors. Dye in the ordinary bath, according to sample, with genuine red, ponceau, or orange, and pensée lake.

The first and the latter coloring-matters yield bluish tones; orange and pensée lake more yellowish and dull colors.

8. *Marine, admiral.* Dye with pensée lake, indigo-carmine, and marine-blue of best quality. Besides with these coloring-matters, final shading may also be effected with acid violet and acid fuchsine. Acidity and heat of the bath as usual.

t. Russe. Dye in a bath acidulated with sulphuric acid with azo-yellow and acid green. Shade with indigo-carmine or pensée lake, eventually also with marine-blue, and, to give the tone some warmth, also with orange. Heat to 200° F.

u. Gray-blue colors. Water-soluble aniline, pale blue, with gray, extra superfine, in a bath acidulated with sulphuric acid. Shade, according to sample, with acid violet, pensée lake, or indigo-carmine. Acidity and heat as usual.

v. Green-blue colors. Pale blue, acid green. Shade, according to sample, with azo-yellow, indigo-carmine, or pensée lake, also orange. Acidity and heat of the bath as usual.

w. Maroon, loutre. Dye in the ordinary bath with orange and pensée lake. Shade with azo-yellow, fast brown, and indigo-carmine as well as marine-blue.

Remarks. From *d* on, the bath, if not otherwise mentioned, is always acidulated with sulphuric and tartaric acids, so that a slight excess of them can be detected by the taste. The temperature of the bath is at first kept at 145° F., and in dyeing increased to 200° F.

Ombré (*shaded*), *tricolored.* Dye the feathers the palest color of the sample, which is generally on the point. Then, for the reception of the second color of the sample, stretch the feathers in a frame which is effected as follows:—

Take two strips and place them across the shading-box described below, so that they project about 2 inches on each side. The strips may be either of wood $1\frac{1}{4}$ inches wide and $\frac{3}{4}$ inch thick, or of stout sheet copper. One of each pair of strips is provided near each end

and in the centre with copper screws which accurately fit into holes in the other strip. Cover the strip provided with screws with a rubber strip of the same size, and upon the latter place feathers alongside one another up to the end screws. Now place upon them another rubber strip of the same size as the first, and fit the other copper strip upon the screws. Then screw both strips together by means of strong nuts, so that the intermediate space not occupied by feathers is filled up with rubber.

The entire lot being thus stretched in strips, the feathers are taken to the shading-box, which consists of a rectangular copper box about $25\frac{1}{2}$ inches long, $19\frac{1}{2}$ inches wide, and $3\frac{3}{4}$ inches deep. It is placed in an exactly horizontal position over the fire, or a steam-pipe is introduced. The box is filled about one-quarter full with water, which is acidulated and the required coloring-matter for the second color to be dyed added. When the dye-bath has acquired the required temperature, place the strips with the feathers across the box, so that the feathers are about three-quarters covered by the dye-bath. Now dye at 200° F., occasionally shaking the strips with feathers, so that the coloring-matter may penetrate as uniformly as possible, and the boundary between the two colors be not too sharply defined.

When the second color has been dyed according to sample, the strips are unscrewed and the feathers shifted. This is effected by drawing them uniformly forward, so that, with the shading-box filled to about the same depth, the darkest (third) color can be applied to full one-half the length of the feather. The strips being again screwed

together, are replaced upon the shading-box, the latter now containing the darker dye-bath.

It may here be remarked, that for *ombré*, as well as *bordé*, indigo preparations, such as indigo-carmine, pensée lake, as well as acid indigo, should as much as possible be avoided, they possessing the property of very readily running into the neighboring pale color, and thus giving a bad appearance to the boundary. Hence, for dark colors it is best to use marine-blue, violet 6 B, or gray, acid green, nigrosine, etc.

The last color having been dyed, a wide vessel is prepared for rinsing. The bath should be slightly acidulated and the feathers stretched in the frame rinsed as far as they project from the latter. The purpose of this is to remove any loosely adhering dark coloring-matter before the feathers are removed from between the strips, otherwise there might be danger of the pale colors of one feather coming in contact with the dark color of another. The feathers are finally taken from between the strips and thrown into an acidulated rinsing bath. When rinsed they are taken out, care being taken that the colors of the same shade lie alongside one another. The feathers are then immediately strung together, swung to and fro, and dried.

9. *Bordé* (*bordered feathers*). *a. Light mirror, dark border.* The cleansed naturally white or decolorized feathers are dyed in accordance with the light mirror of the sample. Three to five of them are then placed one upon the other upon a narrow, four-cornered stick, so that the quills cover one another, and the latter are firmly tied in three places to the stick with twine. When the feathers are spread out, their points and side-

branches then hang down. Now bring hot water into a suitable shallow dish, or, for larger lots, into the shading-box, acidulate, and add the coloring-matter required for the dark border. Then place the sticks, to which the feathers are secured, over the vessel, so that the feathers dip in the dye-bath as far as the border is to extend. After dyeing at 200° F., take the feathers out, rinse in an acidulated water-bath, draw through starch-water, swing to and fro, and dry.

b. Dark mirror, light border. Dye the feathers in accordance with the light border of the sample, and dry without starching. Then firmly tie several thicknesses of paper around the border. The feathers thus protected are then dyed in the ordinary manner in accordance with the dark mirror of the sample. The operation must be performed as rapidly as possible to prevent the protecting cover of the border from soaking through and thus spoiling the latter. Then rinse in a clean water-bath, next in one acidulated with sulphuric acid, and, after removing the paper, rinse once more. The feathers are then strung together, drawn through starch-water, passed through the centrifugal, and dried.

Another method of protecting the first color in the second dye-bath is as follows: Take a copper-plate, similar to those used in shading, but somewhat shorter and wider, and provided only on each end with a screw, which should, however, be about 4 inches long. Several other copper-plates of the same size as the one above described are required. They are, however, only furnished with holes in which the screws of the first plate accurately fit.

Now place the feather, spread out between two rubber

plates of equal size, and the shape of the portion of the feather to be protected, upon the first copper-plate, lay upon it another plate, then a feather between rubber-plates, upon this another copper-plate, and so on alternately as many feathers between rubber-plates and copper-plates as the length of the screws will permit. Now screw the whole together with strong nuts, and dye in accordance with the dark mirror of the sample. After dyeing rinse, and in the second rinsing water, which should be acidulated, take the feathers from between the plates. The feathers are then strung together, drawn through starch-water, passed through the centrifugal, and dried.

It is advisable first to soak the rubber-plates in hot water, so that they become quite soft.

The above described method has the advantage that the feathers can be protected wherever desired, and by the use of properly shaped rubber-plates any required design may be produced. Another method of producing contrasting colors—however, without any special design—is as follows: Firmly wrap twine around the feathers so as to leave a few places free, and dye. The places protected by the twine will remain colorless, or retain the color previously applied, whilst the places left free will show the new color. By now freeing about one-half of the protected portion from twine, and partially covering the previously applied color, and again dyeing, four different colors will be obtained. By thus continuing the manipulation, and carefully choosing the tones so that the colors alongside one another contrast, feathers showing all possible tones may be obtained.

Dyeing Fancy Feathers.

1. *Cleansing.* With the exception of ostrich feathers, the term *fancy feathers* is applied to all kinds of feathers used in the manufacture of ornamental feathers, hence including those from nearly all kinds of birds. There being considerable difference in the content of fat, various methods of cleansing have to be employed. The treatment in dyeing also varies somewhat, since the feathers of many birds show a different behavior towards the coloring-matters.

Chicken feathers containing no fat need not be washed, at least not for dark colors; they only require, before dyeing, to be thoroughly moistened in a hot water-bath acidulated with sulphuric acid. However, it is recommended to once or twice wash all feathers which are to show lustre in a bath of Castile soap.

On account of their content of dirt, most fancy feathers require thorough washing, which is effected as follows:—

For 11 lbs. of feathers prepare a bath of 100° F. to which add 26½ ozs. of good white soap, thoroughly dissolved. Stir the feathers in this bath for about 10 minutes, and then let them stand, well covered by the bath, for one hour. Then after stirring a little more bring them into a sieve.

Now prepare a fresh bath of the same temperature, to which 3 lbs. of Castile soap well dissolved have been added. Handle the feathers well in this bath and then let them stand for one hour, after which they are again thoroughly handled and brought into a sieve. They are then passed in succession through two baths of 100° F.,

to each of which has been added 1 lb. of soda well dissolved. They are handled 10 minutes in each bath. They are then rinsed in two cold water-baths, next in one acidulated with sulphuric acid, and again rinsed in clean water, when they are ready for dyeing. Skins, heads, wings, etc. must be more rapidly handled, and are not worked in the soda-baths, as the fleshy sinews and skin would be dissolved. They are washed for a short time in a good soap-bath, rinsed in warm water and then in water slightly acidulated. White skins, wings, etc., intended for light colors, are washed in two quite concentrated soap-baths, then in two very warm water-baths, rinsed first in slightly acidulated, and finally in cold, water.

2. *Decolorizing.* Decoloration is made use of only for wings and bird skins, and for some larger more valuable varieties of feathers. The process is the same as given for ostrich feathers, which see.

3. *Freeing from fat.* The process is the same as given for ostrich feathers, but is of greater importance here, it frequently being the initial and final operation, after which the articles are ready for the manufacturer. The bath is used according to the various natural designs of the skins, wings, and feathers, the result always being an agreeable tone. The white mixed with the natural design usually suffers somewhat from the chromate of potassium, but is restored by the subsequent saccharic acid bath.

4. *White.* White fancy feathers are brought into a bath of 100° F. which, for every 10 lbs. of feathers, contains two lbs. of dissolved Castile soap. The feathers are thoroughly handled for one-quarter of an hour, and

then taken out. They are next brought into a fresh bath of the same temperature, but containing 3 lbs. of Castile soap in solution, where they remain for one hour, being from time to time thoroughly handled. They are then taken out and, to remove the soap, are worked through two baths of 100° F. each containing 1 lb. of soda. They are then twice rinsed in cold water.

They are next brought into a warm water-bath to which 3 lbs. of peroxide of hydrogen have been added. In this bath the feathers remain for one hour, when they are taken out and brought into a bath of 122° F., to which 1 lb. of bisulphide of potassium has been added. They remain in this bath for one hour, when they are brought into a fresh warm bath acidulated with sulphuric acid. They are then rinsed in a cold bath and next blued, according to sample, in a bath to which best aniline-violet 6B, dissolved in alcohol, has been added. They are then passed through the centrifugal and dried.

Pale blue, marine-blue, or a redder number of violet may also be used for bluing. The reddish tinge of the blue depends on the white; the yellower the latter, the redder the blue must be. The blue must be dissolved in alcohol, since, if dissolved in water, small blue spots are formed in cold bluing.

5. *Dyeing black. a. Chicken feathers.* Twenty lbs. of unwashed feathers are brought into a water-bath of about 200 quarts heated to 200° F. and to which 7 ozs. of sulphuric acid previously diluted with cold water have been added. Stir with a crutch or stick until all the feathers are thoroughly moistened. Then cover and let stand till the next morning.

Mordanting. Fill a kettle which should be free from acid, and have a capacity of at least 200 quarts, with

water and start the fire. When the water boils, add 20 lbs. of logwood and 16 lbs. of fustic, each dye-wood securely tied in a bag, so as to leave plenty of room for expansion. Boil briskly for one hour. Then take out the bags and add $2\frac{3}{4}$ lbs. of best, white argol ground, 2 lbs. of green vitriol, and 23 ozs. each of blue vitriol and chromate of potassium. Stir well on the bottom of the kettle until all is dissolved, then bring the whole to the boiling-point, and finally add sufficient cold water to reduce the temperature of the bath to 145° F.

The feathers having an hour previous to this been taken from the wash-bath, and placed in a sieve to drain off, are now brought into the kettle and stirred, with constant firing, so that they cannot remain for any length of time on the bottom, or on the hot sides of the kettle, otherwise the points might readily scorch.

When the mordanting bath has acquired a temperature of 185° F., the fire is withdrawn and, after handling the feathers for some time longer, cover the kettle in the manner described under "dyeing ostrich feathers black." The feathers remain in the kettle till the next morning, when they are taken out and placed in a sieve. Then empty the kettle, wash it with water (no acid should be used), refill it with water, and start the fire. The feathers are now rinsed four to six times until the rinsing water appears clear. Then fill a barrel with boiling water and dissolve in it $3\frac{1}{2}$ ozs. of chromate of potassium. Bring the feathers into this bath, stir well, and let them stand.

Dyeing. Bring 20 lbs. of logwood into the kettle and boil briskly for one hour. Then remove the bag containing the logwood and reduce the temperature of

the bath to 145° F. by the addition of cold water. The feathers having been allowed to drain off in the sieve for half an hour are then brought into the kettle and thoroughly handled, the temperature of the bath being gradually increased to 194° F. The fire is then withdrawn, and after handling the feathers for some time longer, the kettle is covered in the previously described manner and allowed to stand overnight. The next morning the feathers are brought into a sieve and several times rinsed in cold water, when they are brought into a bath of 100° F. containing 2 lbs. of soda in solution. They are next placed in a fresh bath of the same temperature, containing 10 lbs. of good white soap in solution. Here they are thoroughly handled for one hour, when they are taken out and passed in succession through two soda-baths of 100° F., each bath containing 2 lbs. of soda, when they are once more rinsed.

Treatment with chlorine. The chlorine solution used for this purpose is of the same composition as that employed in chlorinating ostrich feathers. Add some of the solution to a water-bath of about 400 quarts heated to 111° F., stir thoroughly and work the feathers in it. After 10 minutes take out a handful of feathers, place them in a clean water-bath and examine them in a good light. If they cannot be well seen in the water, dry five to ten of them. If the black shows a coppery lustre, add a corresponding quantity of chlorine solution to the bath, stirring constantly. If at the next examination the black appears clear and deep, take the feathers quickly from the bath, rinse them in three or four cold water-baths, pass them through the centrifugal, and dry.

b. Turkey feathers. Wash the feathers according to

directions given under cleansing. They are then in the main treated like chicken feathers, the only differences being as follows: 1. Gently boil the mordanting bath with the feathers for $\frac{1}{4}$ hour. 2. After standing in the mordanting bath overnight, the feathers are taken out and spread out in the air for one hour. 3. During this time add to the mordanting bath used about one-quarter of the quantity of mordant originally employed. 4. Return the cooled feathers to the mordanting bath, heat to the boiling-point and let stand, well covered, overnight. 5. The next morning take them out, cool them in the air and then rinse. The treatments with chlorine solution and dyeing are the same as for chicken feathers, except gently boiling $\frac{1}{4}$ hour.

c. Pigeon feathers. Wash thoroughly according to directions given under cleansing. Then subject the feathers to the same treatment as given under 5*a*, observing the following differences: 1. Instead of moistening in a bath acidulated with sulphuric acid, wash thoroughly as above mentioned. 2. For mordanting take $\frac{1}{6}$ part *more* fustic and bring the bath with the feathers to the boiling-point. 3. Boil for a short time in the dye-bath. 4. Omit the soap and soda-bath.

d. Goose and duck feathers. Wash thoroughly according to directions given under cleansing. Then treat the feathers in the same manner as given under 5*a*, observing the following differences: 1. The mordanting bath should contain $\frac{1}{4}$ *more* fustic. 2. Boil in the mordanting and dye-baths for half an hour. 3. Omit the soap and soda-baths.

e. Peacock feathers. The treatment is the same as for ostrich feathers, but the feathers must be freed from

their natural bronze by treating them according to directions given under "Dyeing ostrich feathers, 3."

f. Parrot feathers. Treat the same as given for turkey feathers, but first remove the natural bronze according to directions given under 3. The temperature of the baths should not exceed 167° F.

g. Skins of kingfishers and magpies. Treat the skins in a concentrated bath of good white soap, and then rinse in several warm waters. They are then placed for one hour in a strong chlorine bath of 100° F., prepared according to directions given under "Dyeing ostrich feathers, 5." They are then rinsed twice in cold water and next brought into a strong logwood bath of 100° F., where they remain for two hours. Then, without rinsing, they are placed for half an hour in a bath of medium strong potash solution heated to 100° F. Next rinse thoroughly and return them to the logwood bath for one hour. Then rinse thoroughly, draw them through a good soap-bath, rinse again, and finally treat with chlorine.

h. All other kinds of birds, wings, skins, heads, and tails. Wash according to directions given under cleansing. Dye as given under 5*a*, but the temperature of the bath should not exceed 167° F.

6. *Bronze. Green, olive, gold.* The feathers are dyed black, and rinsed, but not treated with chlorine. They are then dyed in the same manner as given for ostrich feathers.

7. *Other colors, including fashionable colors.* The treatment is the same as given for ostrich feathers.

8. *Ombré.* The same directions as given for ostrich feathers also apply here, but for fancy feathers two

colors are, as a rule, only demanded. As regards the variation in the treatment of fancy articles from ostrich feathers, the reader is referred to the section "Treatment in general."

9. *Changeant.* Parrots, as well as other birds and wings, are decolorized according to directions given under "Dyeing ostrich feathers, 2." They acquire a beautiful changeant if dyed cream-color (see ostrich feathers, 7), and dried at rest. Next prepare a neutral bath of 122° F., with very little eosine, and in this bath handle the cream-color dyed wings, etc., without previous wetting, for a short time. The dry articles become only partially wet in the eosine bath, the wetted portions acquiring a salmon color, while those not wetted remain cream color.

A beautiful contrast is also obtained with decolorized larch wings, as well as other wings, etc., which have been dyed mandarin, and dried. By drawing such articles through a solution of brilliant green, the wetted portions acquire an olive color, while the non-wetted portions remain mandarin.

Drying. The difference in the construction of ostrich and fancy feathers necessitates different methods of drying.

Ostrich feathers, after dyeing, are passed through a small bath of cold water, to which a considerable quantity of raw wheat or rice starch has been added, two handfuls of starch being taken for 3 quarts of water and 1 lb. of feathers. The feathers after being thoroughly rubbed in this starch-water are squeezed out and passed through the centrifugal. The separate bunches after being somewhat beaten are hung over a line. A special

frame in the form of a very broad ladder, secured by long ropes to the ceiling, is also used for this purpose. In summer the feathers may be dried in the open air, otherwise a special room which can be heated to 122° F. is required. In the open air they are allowed to hang quietly, it being only necessary to beat them occasionally either between the hands or over the edge of a table. But when drying in a room with no natural motion of the air, the latter must be artificially produced. This is effected by tying the lines upon which the feathers are hung somewhat slack and swinging them, or the above-mentioned frame, to and fro, occasionally beating or shaking the feathers; which may finally be hung up in warm air for one day.

Articles of fancy feathers should not be drawn through starch-water, but after rinsing be passed through the centrifugal.

Feathers of smaller size, such as chicken and pigeon feathers, are brought into the drying drum. This is a double-walled copper cylinder with perforated ends. A steam-pipe for heating the drum is placed between the two walls. The feathers are introduced into the drum through an aperture on the side, while the moisture escapes through the perforated ends. The drum is revolved by means of a crank until the feathers are dry.

Skins, wings, etc., are almost completely dried in a quiescent state. They are then brought into the drum, so as to receive a steam bath from the moisture remaining in them, which gives them a beautiful appearance.

Larger fancy feathers, such as the tail feathers of roosters, etc., may be strung together like ostrich feathers, and dried upon the line. They are, however, not drawn through starch-water.

VII.

DYEING GARMENTS.

CONSIDERABLE general experience is required to be able to dye worn garments in an approved style, the operation being a combination of the three principal branches of dyeing, viz., of silk, woollen, and cotton. An essential factor, namely, the original color, has also to be taken into consideration, and, furthermore, the fact that the garment while in use has not been uniformly exposed to the action of light and air, which, independent of the difference in appearance of the various parts, very readily causes an unequal absorption of the coloring-matter by the tissue. Stuffs of mixed fibres especially require careful treatment, as otherwise, for example, in dyeing the cotton in a fabric, the wool in the same fabric might acquire a bad appearance, or combine only externally with the coloring-matter, and consequently lose color when in use.

Hence coloring-matters and mordants have to be used, which overcome such inequalities as much as possible.

Dyeing Silk Garments and Ribbons.

Silk garments to be dyed a light color must show a white ground, or the old color should be of such a nature that it can be entirely removed by washing, or, at least, a clear, light tone, similar to the color to be

dyed, should remain after washing. However, beautiful light colors can only be produced upon a white ground, and even then it will be possible to trace a few places which by perspiration, dirt, or contact with air and light have acquired a different affinity for the coloring-matter.

After washing and in dyeing the greatest care is required, and perfect cleanliness should prevail. All crumpling together of the articles should be avoided, and it is therefore advisable to let the garments remain in the last rinsing water until dyeing commences. For dyeing, copper kettles should be avoided, or, if this cannot be done, the kettle should be very wide, so that in handling the articles they do not come too much in contact with the sides of the kettle, otherwise copper-stains, or so-called *kettle-stains*, may be readily formed. Another reason for the employment of a wide kettle is, that by laying closely together in a narrow kettle creases difficult to remove are readily formed, especially in heavy silk garments.

As regards dyes for silk fabrics, the acid aniline colors may be recommended. For the production of deeper full tones, they may be combined with indigo, pensée lake, etc. The silk fibre combines with these coloring-matters without a mordant, it being in most cases only necessary to acidulate the dye-bath with sufficient sulphuric acid that its presence can be detected by the taste. However, for black, as well as all other dye-woods, quite strong mordants are required.

It is of great importance that the dye-baths should not be used too hot, and it is not necessary to raise the

temperature of the dye-bath if the coloring-matter has been fully and uniformly absorbed by the articles.

Washing. The articles are spread out upon a zinc plate or table, and the parts soiled by dirt or perspiration treated, by means of a soft brush, with a concentrated solution of good white soap heated to 122° F. After thus going over the entire lot to be dyed, the garments, etc., intended for the lightest color are gently boiled in a Castile-soap bath for one-quarter of an hour. For articles to be dyed dark, good white soap may be used instead of Castile soap. The garments, etc., are then taken out, drawn through a weak soda-bath of 100° F., and rinsed. The articles intended for light colors are then passed through a warm bath acidulated with sulphuric acid and again rinsed. Articles to be dyed black are treated with brush and soap solution, as above described, and placed in a soda-bath of 100° F. for half an hour.

1. *Black* (5 *lbs.*). A. *Lustrous black. Pickling.* The object of pickling is to remove the original colors and to obtain a uniform ground.

Add to 50 quarts of water in a wooden vessel, 1½ pints of nitric acid, and bring the bath to boiling. Place the articles broad in the bath, let them gently boil, moving them for a short time, then take out and rinse. This manipulation is for blue-black articles. If a deep black is to be produced, add to the hot nitric acid bath 1 lb. of turmeric.

Mordanting. Work the articles in a nitrate of iron bath of 12° B. for one-quarter of an hour, then take out and expose them to the action of the air for half an hour. Then rinse in cold water. To remove the iron

which has not entirely combined with the fibre, the articles are finally drawn through a hot water-bath, when they are ready for dyeing.

Dyeing. Add to about 100 quarts of water in a copper kettle a decoction of 4 lbs. of logwood, as well as a good solution of Castile soap, the quantity of the latter depending on the hardness of the water. Sufficient soap—say ½ to 1 lb.—should be added, so that the dye-bath shows a strong foam when stirred. The temperature of the bath should be about 100° F. The garments, etc., are now entered, and while working them in the dye-bath the temperature is gradually raised to the boiling-point. After boiling gently for a short time, and when sufficient logwood has been absorbed by the fibre, take the articles out and draw them through a cold, weak acetic acid bath. Then dry them without rinsing.

B. *Deep black.* Pickle and mordant in the same manner as given under A, but use instead of the last hot water-bath a very weak, warm soda-bath.

Dyeing. Prepare a hot, weak logwood-bath, work the garments, etc., in it for one-quarter of an hour, take them out and enter them cold in a fresh bath of 4 lbs. of logwood. Then, whilst constantly working them, raise the temperature of the bath to boiling, then take out, rinse, and—

Treat with chlorine, the object of which is to remove an excess of coloring-matter. Prepare a water-bath of from 145° to 167° F., and add about 1 pint to 1 quart of Javelle water—to be described later on. Work the silk in this bath for some time, until it appears deep black when drawn through a clean, cold water-bath.

Now rinse several times, let stand in a water-bath for some time, and dry.

Special care is required in treating the garments with chlorine, since, if too much Javelle water is added, the color becomes too meagre, rendering redyeing necessary.

C. *English iron-black.* Pickle as given under A.

Mordanting. Boil the silk, with the assistance of steam, in an English-iron bath of 2° Bé. (see below) in a wooden vessel for ten to fifteen minutes, then rinse well, and—

Dye with logwood and Castile soap, as given under A. Then treat with a special chlorine solution, the mode of treatment being the same as given under B.

D. *With fustic or quercitron.* After cleaning and, if necessary, pickling without turmeric, the garments, etc., are placed in a nitrate of iron bath of 8° Bé. for half an hour, then taken out and exposed to the air for half an hour. Now rinse thoroughly and prepare a bath which contains the decoction of 1½ lbs. of fustic or of 1 lb. of quercitron. Work the garments in this bath at from 100° to 140° F. for half an hour. Then take them out and dye in a logwood bath of 4 lbs. of logwood from warm to hot. Rinse and treat with chlorine, as given under B.

Chlorine solution. The chlorine solution (Javelle water) for iron-black is prepared as follows: Dissolve 10 lbs. of chloride of lime and 20 lbs. of soda in 75 quarts of hot water in a wooden vessel. Let the solution clarify for about an hour and keep the clear solution in well-stoppered glass balloons.

Chlorine solution for English black. Dissolve 10 lbs. of chloride of lime, 15 lbs. of crystallized soda, and 20 lbs. of Glauber's salt in 75 quarts of hot water. Let the solution clarify and keep the clear solution in well-stoppered glass balloons.

Nitrate of iron. To 20 lbs. of nitric acid add in small quantities 4 lbs. of pure iron, for instance, small nails, iron filings, etc. When all is dissolved add 7 quarts of water. After cooling, the clear solution is ready for use. A tall stoneware pot should be used for preparing the solution.

English iron. Dissolve with the assistance of heat 20 lbs. of sulphate of iron, 4 lbs. of crude argol, and 4 lbs. of bluestone in 10 quarts of water.

2. *Dark brown* (5 lbs.). For this color pickling with nitric acid in the same manner as given for black under 1 A is also of advantage.

A. Prepare a bath acidulated with $3\frac{1}{2}$ ozs. of sulphuric acid and containing $3\frac{1}{2}$ ozs. of aniline-orange No. 2 (medium) and $8\frac{1}{2}$ ozs. of indigo-carmine or pensée lake in solution. In this bath dye the garments, etc., working them constantly and gradually raising the temperature to 190° F., and eventually to gentle boiling. Then finish according to the shade desired with aniline fast brown, pensée lake, and azo-yellow. Rinse.

B. After pickling the silk is mordanted in a nitrate of iron bath of 2° Bé. for half an hour, then rinsed and drawn through a hot water-bath.

Dye in a bath of from 89° to 100° F., which besides 1 lb. of archil contains the decoctions of 3 lbs. of fustic, 1 lb. of Brazilwood, and, according to the dark tone of the color to be dyed, from 5 ozs. to 1 lb. of

logwood. Work thoroughly, gradually raising the temperature to 195° F., and eventually to boiling. Then take out and rinse.

C. Dye yellow in a bath which contains 8 ozs. of annotta and 5 ozs. of calcined soda. Heat gradually to 167° F. and add to the bath 3¼ ozs. of sulphuric acid. Work the silk in this bath for ten minutes. Then mordant the garments in an alum-bath of 14 ozs. of alum heated to 100° F. for three to six hours. Rinse and dye in decoctions of 1 lb. of fustet, 1½ lbs. logwood, and 2 lbs. Brazilwood. Enter the garments at 100° F. and dye to 190° F., and eventually to gentle boiling. Then take out and rinse.

D. Add to a water-bath of 122° F. a clear solution of ½ lb. of yellow catechu and 2 lbs. red catechu, and work the garments, etc., in the bath for one-half to one hour. Then take them out, rinse, work them in a chromate of potassium bath, containing 2½ ozs. of chromate of potassium, heated to 89° F., for half an hour and rinse. For a darker brown use a mordanting bath of 7 ozs. of alum for one hour and dye in a "hand-heat" bath of decoction of logwood, fustic, and Brazilwood. Fustet may be substituted for fustic.

3. *Coffee-brown* (5 *lbs.*). Prepare a bath of 5 lbs. turmeric, ½ lb. archil extract, ½ lb. indigo-carmine, 5 ozs. sulphuric acid, and 10 ozs. alum. When all is dissolved enter the garments at 145° F. Dye, with thorough working, until the bath has acquired a temperature of 190° F., though eventually it may also be brought to boiling. Then take out and rinse.

Coffee-brown may also be dyed according to either of the directions given for dark brown, it being only

necessary to increase the quantity of the yellow coloring-matter.

4. *Tobacco-brown* (5 *lbs.*). A. Dye the silk in a bath which besides 2½ ozs. sulphuric acid and 7 ozs. alum contains 2½ ozs. azo-yellow, 1 oz. of orange No. 2 (medium), and 2½ ozs. of pensée lake in solution. Enter warm, and gradually heat, with constant handling, to boiling. Rinse.

B. Boil 3 lbs. of turmeric, 10 ozs. archil, 1½ ozs. indigo-carmine, 10 ozs. alum, and 2½ ozs. sulphuric acid, and add the whole to a bath of 145° F. Enter the garments, etc., and dye up at the boiling-point.

5. *Gold* (5 *lbs.*). A. Dissolve 3½ ozs. azo-yellow, ½ oz. orange No. 2 (medium), ⅝ oz. pensée lake, 5¼ ozs. alum, and 3½ ozs. sulphuric acid, and dye the silk in the bath heated to from 145° to 200° F.

B. Boil in a water-bath 3 lbs. turmeric, ⅝ oz. archil extract, ½ oz. sulphate of indigo, 14 ozs. alum, and 1¾ ozs. sulphuric acid. Allow the bath to cool to about 167° F., enter the garments and work them until the dye has been uniformly absorbed and the temperature of the bath raised to 200° F. Then take out and rinse.

6. *Bordeaux* (5 *lbs.*). A. Prepare a bath which contains the following in solution: 4¼ ozs. of sulphuric acid, 2½ ozs. acid fuchsine, 1¾ ozs. fast red, ½ oz. indigo-carmine. Enter the garments at 145° and work them for about half an hour up to boiling, when they are finished.

B. Dissolve 1¾ ozs. each of aniline-bordeaux B and fast red, ½ oz. of acid violet 6B, 3½ ozs. sulphuric acid, and 8 ozs. alum. Enter the garments, etc., at 145° F., and dye, with thorough working up to 200° F.

7. *Garnet* (5 *lbs.*). A. Bath: Sulphuric acid 3½ ozs., ponceau 3R 6 ozs., indigo-carmine 1 oz. Treatment the same as Bordeaux.

B. Dissolve in a kettle 4¼ ozs. of brilliant ponceau, 1 oz. fast red, and ⅓ oz. pale blue, and add 2½ ozs. sulphuric acid. Enter the articles and dye in the usual manner up to boiling.

8. *Ponceau* (5 *lbs.*). A. The bath consists of the solution of 5¼ ozs. saccharic acid and 1¾ ozs. each of sulphuric acid and brilliant ponceau 2R. Dissolve well and dye up to boiling.

B. Dissolve 8 ozs. each of saccharic acid and tin salt, 1⅓ ozs. sulphuric acid, 1¾ ozs. ponceau 3R, and ¾ oz. ponceau G. Dye in the same manner as A.

C. *Bright red.* Mordant the silk articles in the tin mordant (given below) at 3° Bé. for 12 hours, then take out and rinse. Now boil 26 ozs. of cochineal twice and pour both decoctions into a wooden vessel. When the dye-bath has acquired a temperature of 134° F., work the mordanted articles in it for some time, and then allow them to remain for six or eight hours. Then take out and rinse.

Tin mordant. Fill a glazed pot one-half or three-quarters full with 4 lbs. of hydrochloric acid and 1 lb. of nitric acid, and gradually dissolve in the mixture 12 ozs. of pure tin.

9. *Cardinal* (5 *lbs.*). A. The bath consists of 5¼ ozs. of saccharic acid, 1¾ ozs. sulphuric acid, 2½ ozs. brilliant ponceau, and ⅓ oz. genuine red. Dissolve well and dye in the usual manner from 145° F. to boiling.

B. Dissolve 2½ ozs. diamond fuchsine and 8 ozs. turmeric. Dye at from 145° to 167° F.

10. *Scarlet* (5 *lbs.*). Dissolve 8 ozs. of saccharic acid, 1 oz. of sulphuric acid, and $1\frac{3}{4}$ ozs. of ponceau G. Enter the garments, etc., at 145° F., and dye, with thorough working, until the bath has acquired a temperature of 200° F.

11. *Cream* (5 *lbs.*). The articles, after passing through a hot saccharic acid bath, are dyed, without acid, in a very pure water-bath of from 100° to 167° F., which contains $6\frac{1}{4}$ drachms of pale yellow in solution. For a cream without a greenish tinge, add $\frac{1}{2}$ to 1 drachm of orange.

12. *Ivory* (5 *lbs.*). Treat in the same manner as cream. The dye-bath consists of $9\frac{1}{2}$ drachms of pale yellow and $1\frac{1}{2}$ drachms of orange No. 2.

13. *Rose-color* (5 *lbs.*). A. After passing the silk through a hot saccharic acid bath, dye in a neutral bath —*i. e.*, without acid—at from 122° to 167° F. The solution consists, according to the tone desired, of from $5\frac{1}{2}$ drachms to 1 oz. eosine (yellowish or bluish).

For a rose-color of a more yellowish tinge than produced by eosine, add a small quantity ($\frac{1}{2}$ to 1 drachm) of pale yellow.

B. Dye the garments, etc., in a neutral bath of 122° F., with from $2\frac{1}{2}$ to 8 drachms of diamond fuchsine I[a].

C. Dye in a neutral bath at from 145° to 167° F., with from $2\frac{1}{2}$ to 11 drachms of safranine.

14. *Salmon* (5 *lbs.*). Treat the same as rose-color A, but add more pale yellow.

15. *Carail* (5 *lbs.*). Pass the articles through a saccharic acid bath, and dye in a neutral bath at from 122° to 167° F., with 1 oz. each of eosine (yellowish) and pale yellow.

16. *Pale blue, ciel* (5 *lbs.*). A. Work the silk in a clean bath, to which 4½ drachms of water-soluble, superfine aniline pale blue have been added, for ¼ hour at 190° F. Then take it out and add to the bath 2½ ozs. of sulphuric acid. Now return the articles to the bath, and after working them for ¼ hour, take them out and draw them through a cold water-bath.

B. (*Alkaline blue.*) Dissolve in a bath 1⅓ ozs. of alkaline blue 6B, and 8 ozs. of borax or 10 ozs. of soda. Enter the garments, etc., at 100° F., and while thoroughly working them, heat the bath to 167° F. Then take them out and prepare a fresh cold bath, to which add 5¼ ozs. of sulphuric acid. In this bath work the silk for ¼ hour, take out and rinse.

17. *Marine-blue* (5 *lbs.*). A. Prepare a bath, to which add 3½ ozs. sulphuric acid, 8 ozs. alum, 5¼ ozs. indigo-carmine, and 8¼ drachms marine-blue I[a]. Dye the garments, etc., in this bath at 190° F., take them out and add to the bath 3½ ozs. pensée lake and 8¼ drachms marine-blue. Dye, heating up to the boiling-point, until the coloring-matter has been uniformly absorbed.

For a marine-blue with a less reddish tinge (admiral-blue), use less aniline marine-blue and more indigo-carmine.

B. Dissolve 14 ozs. alum, 2½ ozs. sulphuric acid, 12¼ ozs. indigo-carmine, and 1¾ ozs. archil extract. Enter the garments, etc., and dye at 190° F.

C. Steep the silk for two hours in a bath consisting of a solution of 2 lbs. alum. Take out, rinse, and dye in a decoction of from 1 to 2 lbs. logwood at from 167° to 195° F.

18. *Heliotrope* (5 *lbs.*). A. Dye the silk in a bath of $2\frac{1}{2}$ ozs. sulphuric acid, $5\frac{1}{2}$ drachms acid violet 6B, and $8\frac{1}{4}$ drachms acid violet R up to 167° F. According to whether the heliotrope is to be bluish or reddish, use a larger quantity of the first or the latter coloring-matter. If a dull shade is desired, add orange or azo-yellow.

B. Mordant in an alum bath of 10 ozs. alum for two hours, and dye in a warm logwood bath of 7 ozs. logwood.

19. *Prune* (5 *lbs.*). Bath: $2\frac{1}{2}$ ozs. sulphuric acid, $8\frac{1}{4}$ drachms genuine red, and $1\frac{3}{4}$ ozs. acid violet 6B.

Dye according to directions given under 18 A, and shade according to sample: for dull tones with orange, for clear tones with acid fuchsine and acid violet.

20. *Gensdarme* (5 *lbs.*). A. Dye in a bath to which $2\frac{1}{2}$ grammes sulphuric acid and the solutions of 14 drachms water-soluble, superfine pale blue and $6\frac{1}{2}$ drachms acid green have been added, up to 195° F.

The same shade may also be produced with indigo-carmine, turmeric, and alum.

B. Dissolve 4 ozs. indigo-carmine, 8 drachms azo-yellow, 8 ozs. alum, and $1\frac{1}{2}$ ozs. sulphuric acid, and dye up to boiling.

C. Dissolve $1\frac{1}{4}$ ozs. alkaline blue 6B and $1\frac{1}{2}$ ozs. borax, and move the articles in the bath for one-quarter hour, gradually raising the temperature to 167° F. Then dye in a fresh bath with $3\frac{3}{4}$ drachms picric acid and $3\frac{1}{2}$ ozs. sulphuric acid at 200° F.

21. *Peacock-blue* (5 *lbs.*). A. Dissolve in a bath 14 drachms water-soluble, superfine pale blue and $2\frac{3}{4}$ drachms acid green. Dye the articles in the hot bath, and eventually shade, according to sample, with both coloring-matters at 200° F.

B. Work the silk for one-quarter hour in a bath containing 1¼ ozs. alkaline blue 6B and 1½ ozs. borax. Then dye up at 195° F. in a fresh bath with 2½ drachms picric acid.

22. *Steel-blue* (5 *lbs.*). Dissolve 1¾ ozs. alkaline blue 6B and 4 ozs. soda, and move the garments in it for half an hour, raising the temperature to 167° F. Then dye up at 200° F. in a fresh bath with 14 ozs. indigo-residue, 2½ ozs. sulphuric acid, and 8 ozs. alum.

23. *Gray-blue* (5 *lbs.*). Dye the silk in a bath which contains 2½ ozs. sulphuric acid, 14 drachms water-soluble, superfine pale blue, and 8¼ drachms extra-superfine aniline-gray. Work the garments, gradually raising the temperature to 200° F. Shade, if necessary, according to sample, with both coloring-matters and pensée lake (or indigo-carmine), orange, and fast brown.

24. *Vesuve* (*dull fiery tones*) (5 *lbs.*). Prepare the bath with 3½ ozs. sulphuric acid and solutions of 1¼ ozs. orange No. 2 (medium), 5 ozs. ponceau 3R, and 14 drachms each of indigo-carmine (or pensée lake) and azo-yellow. Dye up nearly to boiling. For orange and ponceau 3R, ponceau G or brilliant ponceau may be substituted.

25. *Siam* (5 *lbs.*). Dissolve in the bath 5 ozs. orange No. 2 (medium) and 1½ ozs. of pensée lake, and add 2½ ozs. of sulphuric acid. Dye up at 200° F.

26. *Silver-gray* (5 *lbs.*). A. Dissolve in the bath 1½ ozs. sulphuric acid, 1½ drachms acid violet R, and 8¼ drachms of aniline-gray, superfine extra. Dye at from 167° to 195° F.

B. Work the garments for ¼ hour in a weak nitrate of iron-bath, the rust particles of which have been pre-

cipitated with a little sulphuric acid. Rinse well, and dye in a warm bath with a little logwood and very little Brazilwood.

27. *Vieux-rose* (5 *lbs.*). Dye the silk up to 195° F. in a bath containing 2¼ ozs. sulphuric acid, 5½ drachms indigo-carmine or pensée lake, and 14 ozs. ponceau G. It may also be shaded, according to sample, with azo-yellow, orange, fast red, and pensée lake or acid violet.

28. *Beige* (5 *lbs.*). Sulphuric acid 2¼ ozs., orange No. 2 (medium) and pensée lake, each 8¼ drachms.

For yellow beige, azo-yellow as well as fast brown, etc., may be used. Dye in the usual manner.

29. *Gray* (5 *lbs.*). A. Bath: 2¼ ozs. sulphuric acid and 1¼ ozs. aniline-gray, extra superfine. Dye at 195° F. and eventually shade with a little orange or fast brown.

B. Move the articles for 10 minutes in a cold bath which contains as a mordant 1 oz. of nitrate of iron and 2½ drachms of tin salt. Rinse thoroughly and dye in a bath of 167° F. to which a decoction of 8 ozs. of logwood has been added.

30. *Bright green* (5 *lbs.*). Azo-yellow 1¼ ozs., acid green 14 drachms, sulphuric acid 2¼ ozs. Dye until the green has been uniformly absorbed, eventually boiling gently for a short time.

31. *May green* (5 *lbs.*). Sulphuric acid 2¼ ozs., azo-yellow 1½ ozs., acid-green 14 drachms, and orange No. 2 2 drachms. Dye as given under 30.

32. *Chartreuse* (*pale yellow-green*) (5 *lbs.*). Sulphuric acid 3¼ ozs., azo-yellow 2¼ ozs., acid green 11 drachms. Dye according to directions given under 30 (bright green).

33. *Pale green* (5 *lbs.*). Mordant the garments, etc., in an alum-bath of 1½ lbs. alum for six hours. Then rinse well and dye at a hand-heat in the decoction of 2 lbs. dyer's weed (weld) neutralized with 1½ ozs. argol.

34. *Green* (5 *lbs.*). Mordant the garments in the solution of 2 lbs. alum for 24 hours. Then rinse and dye at a hand-heat in the dyer's weed-bath. When the garments show a full yellow color take them out and add to the bath 8 ozs. indigo-carmine. Return the garments to the bath and work them till the bath boils; then take them out and dry.

35. *Cresson* (*dull yellow-green*) (5 *lbs.*). Sulphuric acid 3¼ ozs., acid green 1¼ ozs., azo-yellow 1½ ozs., orange G 6¼ drachms, aniline-gray, extra superfine, 1¼ ozs. Dissolve all in a bath and dye the articles in it till they appear uniformly colored; finally boil gently for a short time.

36. *Moss-green* (5 *lbs.*). A. Dissolve 2¼ ozs. sulphuric acid, 1¼ ozs. acid green, 1 oz. azo-yellow, and 8 drachms orange G. Dye up to boiling.

B. Dissolve 1½ ozs. sulphuric acid, 8 ozs. alum, 1 lb. turmeric, 14 drachms indigo-carmine, and 5¼ drachms archil extract. Enter the articles and work them till they have boiled for one-quarter of an hour; then rinse.

37. *Russia green* (5 *lbs.*). A. Sulphuric acid 4¼ ozs., azo-yellow and acid green, each 1½ ozs., orange No. 2 3 drachms, indigo-carmine 1½ ozs., or, in place of the latter, 8 drachms aniline-nigrosine. Dye as given under 36.

B. Sulphuric acid 3¼ ozs., alum 10 ozs., indigo-carmine or pensée lake 8 ozs., turmeric 2 lbs. Darken with 8 ozs. archil. Dye as above.

38. *Olive* (5 *lbs.*). A. Sulphuric acid 3¼ ozs., azo-yellow 2½ ozs., acid-green and pensée lake, each 1½ ozs., and orange No. 2 1¼ ozs. Dye in the usual manner.

B. Sulphuric acid 3¼ ozs., alum 1 lb., turmeric 2½ lbs., pensée lake 7 ozs., archil 1 lb.

C. Mordant the garments in an alum-bath of 2 lbs. alum for 12 hours. Rinse and dye to 195° F. in a decoction of 2 lbs. fustic, 1 lb. Brazilwood, and 1½ lbs. logwood.

39. *Cinnamon-brown* (5 *lbs.*). Sulphuric acid 2¼ ozs., azo-yellow 1 oz., fast brown 5¼ drachms, indigo-carmine 6½ drachms. Dye up to the boiling-point.

40. *Pensée* (5 *lbs.*). A. Dissolve in a neutral bath 1 oz. methyl-violet 5B, and dye the garments, working them thoroughly, to 167° F.

B. Sulphuric acid 2¼ ozs., acid-violet 6B 1 oz. and acid violet R 5¼ drachms. Dye to 195° F.

41. *Yellow* (5 *lbs.*). A. Sulphuric acid 2¼ ozs., azo-yellow 14 drachms. Dye to 200° F.

B. Mordant in an alum-bath of 1½ lbs. of alum for 12 hours. Rinse and dye at a hand-heat in a decoction of 2 lbs. dyer's weed (weld).

42. *Mandarin* (5 *lbs.*). Sulphuric acid 2½ ozs., orange No. 2 8 drachms, azo-yellow 1 oz. Dye to 200° F.

42. *Fancy colors and all other intermediate tones.* As fancy colors, may be designated all tones which deviate from the regular ones. They are produced as follows: As ground-colors in dyeing, red, yellow, and blue are used, they being the so-called complementary colors of which all other tones consist.

Now according to the preponderance of one of these

ground-tones, in the desired color, the articles are first dyed with it and shaded with the others.

As materials for the ground-tones may be recommended, for *yellow:* Azo-yellow, Martin's yellow, turmeric; for *red:* Fast red, ponceau, fast brown, and also acid fuchsine; for *yellow and red* together: Orange; for *blue*: Indigo-carmine, pensée lake, or aniline-blue, marine-blue; for *blue and red* together: Aniline acid violet. For the aniline colors the bath is acidulated with sulphuric acid, and for the other coloring-matters with it and alum.

Genuine velvet is dyed in the same dye-baths used for silk garments, but greater care is required in the treatment. Baste around the separate pieces a strip of stuff two fingers wide, by which the velvet is worked during the entire operation. When entering the articles in the bath, place the velvet side down so that in pushing down the wrong side receives the pressure of the hand or stick. After dyeing, immediately apply to the wrong side a solution of gum or gelatine, and dry. As regards the rest, it is treated like cleansed velvet.

Dyeing Woollen Garments and Fabrics.

The affinity of the wool-fibre for coloring-matters is about the same as that of the silk-fibre, both being of animal origin. Hence all directions given for silk may also be used for wool, the chief difference being that the dye-bath must be provided with bisulphate of sodium, which opens the fibre of the wool. Dyeing black, however, is an exception, it differing with wool entirely from silk.

Bisulphate of sodium is imparted to the dye-bath by the addition of sulphate of sodium (Glauber's salt) and sulphuric acid. However in modern times argol—from 15 to 20 per cent. of the weight of the fabric—is only used.

In the main this branch of dyeing, however, possesses its own characteristics, which show themselves especially in fulled fast colors. In garment dyeing these colors are demanded only for cloth articles. For the intimate combination of the wool-fibre with the mordant and coloring-matter a longer boiling heat is also required.

Washing. The garments are separately examined, and the soiled places brushed with a solution of yellow barrel soap. Other stains, such as stearine, wax, oil-paint, petroleum, etc., are removed by the application of various agents, for instance, alcohol for wax and stearine, fusel oil for oil-paint, and also for stearine and wax, benzine for petroleum, etc. Then work the articles in a quite concentrated soda-bath of 100° to 122° F. for 20 minutes, and rinse well.

A more reliable plan is to wash the garments intended for colors in a warm soap-bath upon the washboard before working them in the soda-bath.

1. *Black* (22 *lbs.*). A. *Naphthol-black.* Boil $4\frac{2}{5}$ lbs. argol, 21 ozs. naphthol-black, and $1\frac{3}{4}$ ozs. acid green in the kettle until all is thoroughly dissolved, and then cool the bath to 145° F. Enter the articles broad and boil, while working them thoroughly, for $\frac{3}{4}$ hour. Take out and rinse well.

B. *Imperial black.* Boil $4\frac{2}{5}$ lbs. of imperial black and $8\frac{4}{5}$ ozs. of saccharic acid in the kettle until the imperial black is dissolved, which requires $\frac{1}{4}$ hour or more.

Then cool with cold water, enter the articles and boil, while thoroughly working them, for ¾ hour. Then take them out and dissolve in the same bath 26½ ozs. of soda. Now, without further heating the dye-bath, re-enter the garments and handle them for five minutes longer. Then take them out, rinse, and treat them at a hand-heat with chlorine solution. Finally rinse well. The chlorine fluid used for the purpose is prepared as follows: Dissolve 10 lbs. chloride of lime and 20 lbs. soda in 300 quarts hot water, set aside to clarify, and use the clear fluid.

C. *Potash-black.* Boil the articles for one hour in a kettle containing 6 ozs. chromate of potassium, 2⅘ ozs. bluestone, 7 ozs. red argol, and 5¼ ozs. sulphuric acid. *Dye* with a decoction of 6⅗ lbs. logwood, boiling for three-quarters of an hour. Treat with chlorine solution as given under "B Imperial black."

D. *Beaver-black.* Boil the garments for 1½ hours in a bath which contains in solution 2¾ lbs. copperas, 3½ ozs. bluestone, 10½ ozs. red argol, and 14 drachms alum. Then take them out, and after cooling let them lie till the next day. Then rinse and dye in a bath in which 7¾ lbs. logwood and 2 lbs. fustic have been boiled for one hour. Boil the garments in this bath for one hour, handling them thoroughly, then take them out and rinse. They are now passed through a warm bath slightly acidulated with sulphuric acid, and again rinsed.

E. Boil in the kettle 26½ ozs. of logwood extract, 23 ozs. argol, and 17½ ozs. bluestone, until all is dissolved. Cool the bath, enter the articles, and boil for 1½ hours. Take out, pass them through a cold sulphuric acid bath and rinse.

2. *Dark brown* (22 *lbs.*). A. Dissolve in the kettle $5\frac{1}{4}$ ozs. orange No. 2 (medium), $2\frac{4}{5}$ ozs. fast brown, $26\frac{1}{2}$ ozs. indigo extract, and $4\frac{2}{5}$ lbs. argol. Cool the bath, enter the articles, boil, with constant working, for one hour, take out and rinse.

B. Dissolve in the bath $2\frac{1}{10}$ lbs. Glauber's salt, 7 ozs. sulphuric acid, $2\frac{1}{10}$ lbs. turmeric, 7 ozs. fast brown, and $26\frac{1}{2}$ ozs. indigo extract. Cool the bath, enter the garments, boil, with constant working, three-quarters of an hour, take out and rinse.

It may here be remarked that rinsing is always necessary, except when otherwise specified.

C. *Archil-brown.* Boil in the kettle for 10 minutes $26\frac{1}{2}$ ozs. alum, $12\frac{1}{4}$ ozs. argol, 7 ozs. sulphuric acid, $4\frac{2}{5}$ lbs. turmeric, $6\frac{3}{5}$ lbs. archil or $26\frac{1}{2}$ ozs. archil extract, and $2\frac{1}{10}$ lbs. indigo extract or 21 ozs. acid indigo. Cool the bath, enter the garments, and boil $1\frac{1}{2}$ hours.

Indigo sulphate. Triturate 1 lb. of Bengal indigo in a mortar so as to pulverize it as much as possible. Then bring 4 lbs. of fuming sulphuric acid into a tall stoneware pot and place the latter in lukewarm water or in the sun. Now add at intervals of 10 minutes a spoonful of indigo to the acid. Should the acid not come to a boil during this operation, add some common salt. After a few hours, when all the indigo is dissolved, add 2 or 3 quarts of water and stir, when the indigo is ready for use.

D. *Chrome-brown, also for cloth articles.* Dissolve in the kettle 7 ozs. chromate of potassium, $3\frac{1}{2}$ ozs. bluestone, 7 ozs. argol, and $4\frac{1}{4}$ ozs. sulphuric acid. Enter the articles, work them, and let boil for one hour. Then take them out, let them lie till the next day, rinse and dye.

Boil in the kettle for half an hour 39½ ozs. fustic or fustet, 4⅖ lbs. Brazilwood, and 17½ ozs. logwood. Dye the articles in the boiling bath for half an hour.

E. *Wood-brown.* Dissolve in the kettle 12¼ ozs. chloride of tin and 17½ ozs. argol, and boil the garments in it for one hour. The next day rinse and dye for one hour in a boiling decoction of 2⅕ lbs. fustic, 4⅖ lbs. Brazilwood, and 17½ ozs. logwood.

F. *Wood-brown for cloth articles, perfectly fast.* Dye pale blue in the pastel-vat and rinse. Then boil in the kettle for one and one-half hours with 39½ ozs. alum, 10½ ozs. argol, 5 ozs. bluestone, 26½ ozs. fustic. Take out, cool and let lay for twenty-four hours. Then rinse and dye in 6⅗ lbs. madder, 26½ ozs. sumac powder, and 8¾ ozs. logwood. Boil for one hour. For *dark brown*, dye in the same bath with 17½ ozs. copperas. The dye-woods are tied in bags and previously boiled in the bath for half an hour.

G. Boil in the kettle for half an hour 26½ ozs. sanders, 17½ ozs. sumac, 2⅕ lbs. each of turmeric and Brazilwood, and 17½ ozs. logwood. Take out the dye-woods and add to the bath 6 ozs. bluestone, 12¼ ozs. argol, and 3½ ozs. sulphuric acid. Boil the articles in the bath for one and one-half hours, working them thoroughly. Then take them out, rinse, beat, and rinse again.

H. *Sanders-brown.* Boil in the kettle for half an hour 6⅗ lbs. sanders, 4⅖ lbs. sumac, 3⅓ lbs. fustic, and 2⅕ lbs. logwood, and then take out the dye-woods. Boil the articles in this bath for two hours, then take them out, and, for darkening the color, add to the same bath 12¼ ozs. copperas. Return the articles to the bath,

boil them gently for one-quarter of an hour, while working them, and rinse thoroughly.

J. Boil for one hour in 8¾ ozs. chromate of potassium and 5¼ ozs. sulphuric acid. Take out and dye in a bath of 5½ lbs. sanders, 4⅖ lbs. fustic, and 3⅓ lbs. sumac. Boil for one hour.

3. *Coffee-brown* (22 *lbs.*). A. Dissolve 3⅓ lbs. argol, 2½ ozs. sulphuric acid, 2⅕ lbs. turmeric, 7 ozs. orange No. 2, and 17½ ozs. pensée lake, cool the bath, enter the articles, and boil them for one hour, working them constantly.

B. Dissolve 17½ ozs. alum and 8¾ ozs. argol and a mixture of 2 ozs. each of tin salt and sulphuric acid. When all is dissolved, enter the goods and boil for one and one-half hours. Take out, let them cool and allow to lie till the next day. Then rinse and dye in 6⅗ lbs. madder and 2⅕ lbs. logwood. Boil for one and one-quarter hours.

C. *For cloth articles.* Boil the articles for one and one-half hours in a bath containing 5½ lbs. sanders and a decoction of 7⅘ lbs. fustic, 3⅓ lbs. sumac, and 26½ ozs. argol, and take them out. Then add to the same bath 21 ozs. copperas, return the articles to the bath, and boil gently for one-quarter of an hour. Rinse, beat, and rinse again.

By increasing the quantity of yellow coloring-matter, the receipts given under 2 for dark brown may also be used for coffee-brown.

4. *Bordeaux* (22 *lbs.*). Boil in a kettle for five minutes until all is dissolved, 4⅖ lbs. argol, 5¼ ozs. BordeauxB, 14 drachms fast ponceau B and 11¼ drachms indigo-carmine. Cool the bath, enter the garments and

then boil for three-quarters of an hour, working them thoroughly.

B. Dissolve in the bath $5\frac{1}{4}$ ozs. sulphuric acid, $26\frac{1}{2}$ ozs. alum, $3\frac{1}{2}$ ozs. brilliant red, and $5\frac{1}{4}$ ozs. fast red. Enter the garments and boil for half an hour.

C. *For cloth articles.* Dissolve in the bath $8\frac{3}{4}$ ozs. chromate of potassium, $4\frac{1}{4}$ ozs. bluestone, $3\frac{1}{2}$ ozs. argol, and $2\frac{3}{4}$ ozs. sulphuric acid. Cool off the bath, enter the garments, and boil for one hour. Then rinse and dye at a boil for three-quarters of an hour with a decoction of $5\frac{1}{2}$ lbs. Brazilwood and 7 ozs. logwood.

5. *Red-brown* (22 *lbs.*). A. Boil $2\frac{1}{5}$ lbs. alum, $17\frac{1}{2}$ ozs. argol, $4\frac{1}{4}$ ozs. sulphuric acid, $3\frac{1}{3}$ lbs. cudbear, $26\frac{1}{2}$ ozs. turmeric, and $2\frac{1}{2}$ ozs. indigo-carmine. Cool off the bath, enter the garments, etc., and boil for one and a half hours with thorough handling.

B. *For cloth articles.* Boil the articles for one hour in a bath of $8\frac{3}{4}$ ozs. chromate of potassium, $5\frac{1}{4}$ ozs. each of bluestone and argol, and $4\frac{1}{4}$ ozs. sulphuric acid. Rinse, and dye in a bath of $6\frac{2}{5}$ lbs. Brazilwood and $8\frac{3}{4}$ ozs. fustic. Boil for one hour.

6. *Marine-blue* (22 *lbs.*). Dissolve in the kettle $3\frac{1}{3}$ lbs. alum, 7 ozs. sulphuric acid, $3\frac{1}{2}$ ozs. indigo-carmine, and $1\frac{3}{4}$ ozs. marine-blue B. Cool off the bath, enter the garments, and boil for three-quarters of an hour, working them thoroughly. Then to prevent the color from rubbing off, pass the garments, etc., through a weak chlorine solution and rinse. Then to brighten the blue, pass them through a sulphuric acid bath and rinse once more.

B. Dissolve $4\frac{2}{5}$ lbs. argol and $3\frac{1}{2}$ ozs. aniline dark

blue B, and boil the garments in the bath for half an hour, working them thoroughly.

C. *For cloth articles.* Dissolve $4\frac{2}{5}$ lbs. argol, $3\frac{1}{2}$ ozs. French blue (*bleu de Indien*), and $5\frac{1}{2}$ drachms naphthol-black. Boil the articles in the bath for half an hour, rinse, and draw through a weak chlorine bath. Rinse, pass through a sulphuric acid bath, and rinse once more.

D. Dissolve in the kettle $3\frac{1}{2}$ ozs. each of alkaline blue R and borax. Work the garments in this bath at from 167° to 190° F. for half an hour, and then dye at a boil for half an hour in a fresh bath of $5\frac{1}{4}$ ozs. sulphuric acid, $17\frac{1}{2}$ ozs. alum, $2\frac{1}{2}$ ozs. indigo-carmine, and $1\frac{1}{4}$ ozs. marine-blue R.

E. *For cloth articles.* Dissolve $2\frac{1}{5}$ lbs. alum, 7 ozs. sulphuric acid, $5\frac{1}{4}$ ozs. indulin, and $1\frac{3}{4}$ ozs. indigo-carmine, and boil the articles three-quarters of an hour, working them thoroughly. Then rinse, draw through a weak chlorine bath, rinse, pass through a sulphuric acid bath, and rinse once more.

F. *For cloth articles.* Dissolve $5\frac{1}{4}$ ozs. chromate of potassium and $17\frac{1}{2}$ ozs. argol, and boil the articles in the bath for one hour. Then rinse and dye at a boil for three-quarters of an hour in a bath which contains a decoction of $3\frac{1}{5}$ lbs. logwood and $1\frac{3}{4}$ ozs. diamond-fuchsine.

G. *For cloth articles.* Boil the articles for an hour and a half in a bath of $17\frac{1}{2}$ ozs. alum, 7 ozs. argol, $1\frac{3}{4}$ ozs. tin salt, and $3\frac{1}{2}$ ozs. sulphuric acid. Then rinse and dye in a decoction of $3\frac{4}{5}$ lbs. logwood and as much methyl-violet as may be required.

7. *Ponceau* (22 *lbs.*). A. Dissolve in the kettle $17\frac{1}{2}$ ozs. saccharic acid, $3\frac{1}{2}$ ozs. tin salt, and $5\frac{1}{4}$ ozs. each of

sulphurie aeid and brilliant ponceau, and dye at a boil for half an hour.

B. Dissolve in the kettle 2½ lbs. ground eochineal, 21 ozs. saecharie aeid, 14 ozs. tin salt, and 1¾ ozs. sulphuric acid, and boil the garments, ete., in the bath for one hour.

C. *Alizarine red, for cloth articles.* Dissolve in the kettle 4⅖ lbs. alum, 8¾ ozs. tartarie aeid, 2 ozs. tin salt, and 3½ ozs. chloride of tin. Cool off the bath, enter the artieles, and boil for two hours. Then take them out, and after eooling let them lie from twelve to twenty-four hours. Then rinse and dye in a bath whieh eontains 7⅘ lbs. madder. Enter at 145° F. and bring very slowly —in about an hour—to a boil. Then boil gently for one-quarter of an hour and take out.

8. *Bismarck* (22 *lbs.*). A. Dissolve 7 ozs. sulphurie aeid, 2½ lbs. alum, 1¾ ozs. orange No. 2, 14 draehms azo-yellow, and 1¾ ozs. pensée lake. Enter the artieles, dye up to the boiling-point, and let boil for half an hour longer.

B. *For cloth articles.* Boil for one hour in a bath whieh contains in solution 2½ lbs. alum, 12¼ ozs. argol, and 3½ ozs. eaeh of bluestone and ehromate of potassium. Dye in a fresh bath of 26½ ozs. madder and 8¾ ozs. logwood. Boil one hour.

9. *Bright blue* (22 *lbs.*). A. Add to a elean bath 1 oz. 6½ drachms water-soluble aniline bright blue superfine, and work the garments in it for half an hour, heating to the boiling-point. Then take out the garments, add 10½ ozs. sulphurie acid to the bath, return the garments, let them gently boil one-quarter of an hour longer and take them out.

B. *Alkaline blue.* Dissolve in a clean bath 5¼ ozs. alkaline blue B6 and 26½ ozs. soda, and dye the garments at from 100° to 179° F. Then take them out and work them in a fresh cold bath containing 21 ozs. sulphuric acid for one-quarter of an hour.

10. *Gray* (22 *lbs.*). A. Prepare a bath of 10½ ozs. sulphuric acid, 17½ ozs. argol, and 7 ozs. aniline-gray extra superfine. Enter at 145° F., and dye at a boil for one-quarter of an hour. Finally shade with a little orange or fast brown.

B. Boil in the kettle 26½ ozs. alum, 14 ozs. argol, 5¼ ozs. sulphuric acid, 4½ ozs. indigo-carmine, and 3½ ozs. cudbear. Cool off the bath, enter the garments, and dye at a boil for one-quarter of an hour, working them thoroughly.

C. *For cloth articles.* Dissolve in the bath 5¼ ozs. chromate of potassium, 3½ ozs. sulphuric acid, and 14 ozs. argol, and boil the articles in it for one hour. Rinse, and dye in a fresh bath which contains a decoction of 17½ ozs. of logwood and 5¼ ozs. archil, and finally also 3½ ozs. fustic. Boil half an hour.

11. *Beige* (22 *lbs.*). A. Dissolve in the bath 3⅓ lbs. argol, 1¾ ozs. pensée lake, 8½ drachms azo-yellow, and 1 oz. orange No. 2. For the latter two, 1 oz. 6½ drachms orangeG may be substituted. Enter the articles and boil, with thorough working, for half an hour.

B. *For cloth articles.* Dissolve 5¼ ozs. chromate of potassium, 1¾ ozs. sulphuric acid, and 5¼ ozs argol, and in this mordant boil the articles for three-quarters of an hour. Rinse and dye in a fresh bath, to which a decoction of 3½ ozs. logwood has been added. If the beige

is to show a yellow tinge, a decoction of 1¾ to 3½ ozs. of fustic must also be added.

12. *Green* (22 *lbs.*). A. *Bright green.* Dissolve 3½ ozs. sulphuric acid, 14 ozs. alum, 3½ ozs. azo-yellow, and 2½ ozs. acid green, and boil the articles in the bath for half an hour.

B. *Bright green.* Dissolve 2¾ ozs. alkaline blue 6B and 5¼ ozs. borax. Work the garments in the bath at 190° F. Dye in a bath containing 2 ozs. 1½ drachms picric acid in solution and 6 ozs. sulphuric acid. Boil one-quarter of an hour.

C. *May green.* Dissolve in the bath 3½ ozs. sulphuric acid, 14 ozs. alum, 4 ozs. 6½ drachms azo-yellow, 1¾ ozs. acid green, as well as 2¾ drachms orange No. 2. Boil the garments, etc., in the bath for one-quarter of an hour.

D. *Chartreuse.* Dissolve in the bath 3½ ozs. sulphuric acid, 14 ozs. alum, 7 ozs. azo-yellow, and 1 oz. 6½ drachms acid green. Boil the articles in the bath for half an hour.

E. *For cloth articles.* Dissolve 5¼ ozs. sulphuric acid, 17½ ozs. alum, and 1¾ ozs. tartaric acid, and boil the articles in the bath for one hour. Dye with a decoction of 3⅓ lbs. fustic and a solution of 8¾ ozs. in indigo-carmine. With these two coloring-matters, used in varying proportions, all the shades desired may be produced.

F. *Cresson.* Dissolve 4⅖ lbs. argol, 3½ ozs. acid green, 7 ozs. azo-yellow, 14 drachms orange No. 2, and 4 ozs. 6½ drachms of aniline-gray extra superfine. Boil the artieles in the bath for half an hour.

G. *Russia green.* Dissolve 2⅕ lbs. alum, 5¼ ozs. sulphuric acid, 3½ ozs. azo-yellow (or 1¾ ozs. picric acid), 7 ozs. indigo-carmine, 3½ ozs. acid green, and 11 drachms

marine-blue with a red tinge. Boil the garments, etc., in the bath for three-quarters of an hour.

H. *Russia green, for cloth articles.* Dissolve 3½ ozs. sulphuric acid, 3½ ozs. chromate of potassium, and 26½ ozs. alum, and boil the articles in this mordant for one hour. Dye with 21 ozs. indigo-carmine and 2⅕ lbs. turmeric. Boil for half an hour, and eventually darken with 14 ozs. archil.

13. *Moss-green* (22 *lbs.*). A. Dissolve 5¼ ozs. sulphuric acid, 21 ozs. alum, 3½ ozs. acid green, 2½ ozs. azo-yellow, and 14 drachms orange, and boil the garments in this bath for half an hour.

B. Dissolve 4 ozs. 6½ drachms sulphuric acid, 26½ ozs. alum, 3⅓ lbs. turmeric, 5¼ ozs. pensée lake, and 1 oz. archil extract. Enter the articles in the bath, and boil three-quarters of an hour.

C. *For cloth articles.* Dissolve 3½ ozs. chromate of potassium, 2½ ozs. sulphuric acid, and 17½ ozs. alum, and boil the articles in this bath for one hour. Dye with a decoction of 2⅕ lbs. fustic, 12¼ ozs. logwood, and 7 ozs. Brazilwood. Boil half an hour.

14. *Olive-green* (22 *lbs.*). A. Dissolve 2⅕ lbs. alum, 3½ ozs. sulphuric acid, 3½ ozs. azo-yellow, 2½ ozs. orange No. 2, and 5¼ ozs. acid green. Boil the garments in the bath for half an hour.

B. Dissolve 4⅖ lbs. argol, 5½ lbs. turmeric, 17½ ozs. indigo-carmine, and 14 drachms ponceau G, and boil the garments in the bath for three-quarters of an hour.

C. *For cloth articles.* Dissolve 3⅓ lbs. alum, 8¾ ozs. argol, 2½ ozs. sulphuric acid, and 4 ozs. 6½ drachms bluestone, and boil the articles in the bath for one hour. Then dye in a decoction of 6⅗ lbs. fustic, 17½ ozs.

Brazilwood, and 2⅕ lbs. logwood. Boil three-quarters of an hour.

D. *For cloth articles.* Dissolve in the bath 4 ozs. 6½ drachms chromate of potassium, 1¾ ozs. bluestone, and 3½ ozs. sulphuric acid, and boil the articles in it for one hour. Then rinse and dye in a decoction of 6⅗ lbs. fustet, 17½ ozs. Brazilwood, and 2⅕ lbs. logwood. Boil one hour.

15. *Mode* (22 *lbs.*). A. Boil in the kettle for one hour 17½ ozs. each of alum and argol, 3½ ozs. sulphuric acid, 12¼ ozs. fustic, and 3½ ozs. cudbear. Cool off the bath, enter the garments, work them while gradually heating to boiling, take them out, and rinse.

B. Boil in the kettle for one-quarter of an hour 3½ ozs. argol, 6 ozs. bluestone, 10½ ozs. sumac, and 14 ozs. madder. After cooling the bath, enter the garments and work them, while heating to boiling.

16. *Bronze* (22 *lbs.*). A. *For cloth articles.* Boil in the kettle 5½ lbs. fustic, 2¾ lbs. sanders, and 2⅕ lbs. sumac. Boil the articles in the bath for one and one-quarter hours. Then lift them out, let them cool, and add to the same bath 21 ozs. copperas and 7 ozs. bluestone. Return the articles to the bath and, without firing the kettle, work them for half an hour. Rinse thoroughly.

B. Dissolve in the kettle 17½ ozs. argol, 5¼ ozs. picric acid, 7 ozs. archil, and 3½ ozs. indigo-carmine. Boil the garments in the bath for three-quarters of an hour, moving them constantly.

17. *Prune* (22 *lbs.*). Boil in the kettle 2⅕ lbs. argol, 1¾ ozs. sulphuric acid, 17½ ozs. alum, 3⅓ lbs. archil, and 17½ ozs. pensée lake. After cooling the bath, enter the

garments and boil for one hour, working them constantly.

18. *Pensée* (22 *lbs.*). Dissolve in the kettle 5¼ ozs. sulphuric acid, 17½ ozs. alum, 1¾ ozs. acid violet R, and 3½ ozs. acid violet 6B. Enter the garments, work them while heating to boiling, and then let them gently boil for a short time.

B. Add to the bath 3½ ozs. methyl-violet B in solution, and further 8¾ ozs. sulphurous acid and 8¾ ozs. wheat-starch, thoroughly mixed and diluted. Enter the garments at 145° F. and work them for a quarter of an hour at 200° F. Do not boil.

C. *For cloth articles.* Dissolve in the kettle 17½ ozs. alum, 14 ozs. argol, 2 ozs. bluestone, and a mixture of 2½ ozs. each of sulphuric acid and tin salt. After cooling the bath, enter the garments, work them well to the boiling-point, and let them boil for one and one-half hours. Then take them out and after cooling let them lie from twelve to twenty-four hours. Then rinse and dye in a decoction of 3⅓ lbs. logwood and 2½ ozs. each of nutgalls and cudbear.

Powder the nutgalls and add them together with the cudbear to the kettle filled with the logwood decoction. Cool the bath off, enter the articles and work them for half an hour, gradually raising the temperature to boiling.

19. *Yellow* (22 *lbs.*). A. Dissolve in the kettle 3½ ozs. sulphuric acid, 8¾ ozs. saccharic acid, and 3½ ozs. azo-yellow, and work the articles in the bath at a boil for half an hour.

For buttercup-yellow, add to the bath 5½ drachms orange G.

B. Dissolve in the kettle $8\frac{3}{4}$ ozs. each of chloride of tin and saccharic acid, 4 ozs. $6\frac{1}{2}$ drachms tin salt, and $3\frac{1}{2}$ ozs. flavin. Enter the articles at 167° F. and boil them for one-quarter of an hour.

C. *For cloth articles.* Work the articles in a decoction of $6\frac{3}{5}$ lbs. fustic, $26\frac{1}{2}$ ozs. sumac, $12\frac{1}{4}$ ozs. alum, $3\frac{1}{2}$ ozs. bluestone, and $17\frac{1}{2}$ ozs. sanders, and boil them gently for 2 hours.

Havana (22 *lbs.*). Work the garments for half an hour in a boiling bath containing $2\frac{1}{5}$ lbs. catechu in solution. Then treat them in the same manner, in a bath of 4 ozs. $6\frac{1}{2}$ drachms chromate of potassium at 122° F., and for darkening in a bath of $3\frac{1}{2}$ ozs. copperas. Rinse after each bath.

21. *All fancy colors more suitable for garments* may be produced as follows: As a mordant for *light colors*, use $1\frac{1}{2}$ per cent. of the weight of the fabric to be dyed of sulphuric acid and up to 5 per cent. of alum, or in place of the latter (for yellow and red shades) 2 per cent. saccharic acid and 1 per cent. tin salt or chloride of tin. *For intermediate* and *dark colors*, 15 to 20 per cent. argol is used as a mordant. To the same bath add of the three ground-colors, yellow, red, blue, as much as may seem to be required from the appearance of the sample color. Add the principal color first and shade with the other two colors. During dyeing and shading maintain the temperature of the bath at 200° F.

According to the brightness or dulness of the color, different coloring-matters are used for the three ground-colors. For *yellow:* Azo-yellow, flavin, azo-flavin, turmeric, acid yellow, picric acid, etc. For *red:* Brilliant ponceau, ponceau, fast red, congo-red, acid fuchsine,

archil, etc. For *blue:* Bright blue, marine-blue, indigo-carmine, pensće lake, and also nigrosine, the latter for darkening. For *yellow and red* together: Orange. For *red and blue* together: Violet.

22. *All fancy colors more suitable for cloth articles* may be produced according to the following method: *Mordant:* Boil for one hour in $1\frac{1}{2}$ to $2\frac{1}{2}$ per cent. of the weight of the fabric of chromate of potassium, and 4 to 5 per cent. of argol, according to whether the color is to be light or dark. Then dye in a fresh bath with the three ground-colors; for *yellow:* Fustic, turmeric, dyer's weed (weld), fustet, etc. For *red:* Brazilwood, madder, archil, diamond-fuchsine, etc. For *blue:* Logwood, indigo-carmine, indigo extract, pensće lake.

A dyer experienced in shading will, according to the above described methods, be able to dye nearly all fancy colors upon ladies and gentlemen's apparel.

23. *To dye sheepskins.* Sheepskins may be dyed all colors in a similar manner as wool, but the temperature of the bath should not exceed 167° F., a lower temperature being still better. Aniline colors being quite uniformly absorbed by the fibre at a low degree of heat, the directions prescribing their use are especially suitable for this purpose. Neutral aniline colors, if they produce the desired shade, are to be preferred.

The skin-side having lost its fat and tannin by washing and dyeing, it must be again provided with it after dyeing. This is effected as follows: After dyeing and thorough rinsing place the skin, while still wet, with the wool-side upon a clean board. Then carefully rub the skin-side with a handful of pulverized alum and half a handful of common salt, and let the skin lie in a

level position so that both salts may thoroughly soak in. Then dry at a moderate heat, and thoroughly work the skin by rubbing. If it should not become sufficiently soft by this manipulation, rub the skin-side with olive oil.

For black the following directions are given: Place the skins in each of the following baths for one hour. First in a bath of acetate of iron of 4° Bé., next in a very strong bath of copperas, then in a bath of $2\frac{1}{5}$ lbs. sugar of lead, succeeded by a bath of $17\frac{1}{2}$ ozs. chromate of potassium, and finally in a bath of very little water of ammonia. Then dry the skins and draw them through a warm soda-bath. Finally dye in a logwood-bath at 122° F.

Dyeing Cotton and Linen Garments and Fabrics.

Tissues of cotton, linen, and other vegetable fibres generally contain a size derived from the animal and vegetable kingdoms, which fills or envelops the fibre, and thus impedes the uniform reception of the new coloring-matter. Before dyeing, the complete removal of these foreign substances becomes, therefore, necessary. Simple wetting or washing in a soda-bath is not sufficient for this purpose. A reliable method for the removal of the size is as follows: Boil 22 lbs. of the fabric with $3\frac{1}{3}$ lbs. of calcined soda for one hour, rinse, then work it in a hot moderately acid sulphuric acid bath for 10 minutes, and rinse thoroughly.

The affinity of the vegetable fibre for coloring-matters is generally feebler than that of silk or woollen. It has no inclination to combine directly with the coloring-

matter, and has to be induced to do so by impregnation with a tannin. For further fixing the colors, mordants, which vary according to the character of the color to be dyed, are employed.

1. *Black* (22 *lbs.*). A. Tie $6\frac{3}{5}$ lbs. of powdered sumac in sack-cloth, place it in a sieve or basket over an empty barrel and pour water of 190° F. over it. In this manner the best sumac extract is produced, that obtained by boiling the sumac being not so good for the colors.

In place of sumac, one-seventh of its weight of sumac extract dissolved in water of 190° F. may be used. Place the fabrics in the hot sumac bath, and let them remain overnight. Then take them out, work them in an acetate of iron bath for half an hour, and afterwards allow them to remain in the bath for one and a half hours, working them several times in the meanwhile. Then take them out, wring and thoroughly rinse them. Now work them for one-quarter of an hour in a bath which contains 2 ozs. of chromate of potassium. Dye at a hand-heat in a bath of $6\frac{3}{5}$ lbs. logwood and $2\frac{1}{5}$ lbs. fustic. Then work them thoroughly in a size prepared by boiling together, $17\frac{1}{2}$ ozs. wheat-starch, $17\frac{1}{2}$ ozs. joiner's glue, $3\frac{1}{2}$ ozs. tallow or olive oil, and some logwood extract. Then for the uniform distribution of the size, wring out uniformly, beat slightly, and dry.

B. Place the fabrics overnight in a solution of $17\frac{1}{2}$ ozs. bluestone and $26\frac{1}{2}$ ozs. chromate of potassium, heated to a hand-heat. Then take out, wring, draw through water, and dye hot in a bath of $2\frac{1}{5}$ lbs. each of fustic and logwood. Take out and give two fresh logwood baths.

C. Work the fabrics for half an hour in a boiling

solution of $2\frac{1}{5}$ lbs. catechu, then take them out and handle them for one-quarter of an hour in a bath containing $17\frac{1}{2}$ ozs. copperas. Now wring and pass through a bath containing $17\frac{1}{2}$ ozs. dissolved lime. Then rinse and dye in a bath consisting of a decoction of $8\frac{4}{5}$ lbs. logwood.

D. Work the garments for one-quarter of an hour in a warm bath of $8\frac{4}{5}$ lbs. copperas, and then for ten minutes in a solution of $10\frac{1}{2}$ ozs. chromate of potassium. Repeat the same operations once more. Then work the garments in a hot bath containing a decoction of $6\frac{3}{5}$ lbs. logwood and 21 ozs. quercitron until they are black. Then take them out, add to the bath $4\frac{1}{2}$ ozs. linseed oil previously dissolved in some caustic lye (lime-lye and soda), and work the garments in the bath for one-quarter of an hour.

E. *For velvet.* Work the articles for one-quarter of an hour in a medium strong solution of chloride of lime and soda (Javelle water), then take them out and give them a weak logwood-bath. Next work them for one-quarter of an hour in a bath which contains a solution of $8\frac{1}{2}$ ozs. bluestone. Then rinse and give them an acetate of iron bath. Rinse again and draw through a weak soda-bath. Now give another logwood-bath, then an acetate of iron bath; rinse thoroughly, and, if necessary, give a bath of fustic and logwood.

2. *Dark brown* (22 *lbs.*). A. Place the garments, etc., overnight in a hot decoction of $6\frac{3}{5}$ lbs. sumac. Then take them out, wring and work them in an acetate of iron mordant of 1° Bé. for one-quarter of an hour. Rinse and work for half an hour in a cold bath which contains $8\frac{1}{2}$ ozs. of tartar emetic in solution. Then rinse and dye at from 122° to 145° F. in a bath which

contains 4½ ozs. vesuvine and 1¾ ozs. diamond-fuchsine in solution.

B. Dissolve 4⅖ lbs. catechu and add 6 ozs. bluestone to the solution. Work the garments in the boiling solution for half an hour, then take out, wring, work them for half an hour at 134° F. in a bath which contains 10½ ozs. chromate of potassium, and rinse. Now mordant them for two hours in an acetate of alumina bath at 2° Bé., rinse, and dye hot in a decoction of 2⅕ lbs. logwood and 3⅓ lbs. each of Brazilwood and fustic.

Acetate of alumina mordant. This mordant can be obtained in commerce, but may be prepared as follows :—

Dissolve 20 lbs. each of alum and sugar of lead in hot water, and let the solution stand until clear. Pour off the supernatant clear liquor and add the same quantity of hot water to the sediment. Let again stand until clear, and add the supernatant clear liquor to the first.

3. *Coffee-brown* (22 *lbs.*). Treat the garments, etc., according to the directions given under 2 for dark brown, but use a weaker iron bath and double the quantity of yellow coloring-matter.

4. *Bordeaux* (22 *lbs.*). A. Soak the garments, etc., for several hours in the extract of 4⅖ lbs. sumac. For dark Bordeaux, give next a weak iron bath, and rinse. Then work the garments for half an hour in a bath of 7 ozs. tartar emetic, and dye in a hot bath of 1¾ ozs. vesuvine and 4½ ozs. diamond-fuchsine, and, if necessary, a little logwood.

B. Sumac bath as in the preceding, and mordanting for four hours in a bath of 2⅕ lbs. alum and 3½ ozs. tin

salt. Rinse, and dye in a bath of diamond-fuchsine and Brazilwood.

5. *Marine-blue* (22 *lbs.*). A. The garments, etc., receive a hot sumac bath of 6⅗ lbs. sumac, and then a bath of acetate or nitrate of iron. They are then rinsed and worked for half an hour longer in the sumac bath. Then wring and work them for half an hour in a bath containing 8½ ozs. tartar emetic. Rinse, and dye in a hot bath containing 7 ozs. neutral aniline dark blue.

B. Treat as in the preceding, but dye in a hot bath containing 2 ozs. 10 drachms each of fast blue and methyl-violet 6B.

C. Treat in a hot sumac bath as given under A, then mordant for two hours in a bath which contains 2⅕ lbs. alum and 7 ozs. bluestone. Then dye in 6⅗ lbs. log-wood, working the garments, etc., in the bath for half an hour, and darken in a cold bath containing 21 ozs. of copperas in solution.

In place of sumac, 15 per cent. of sumac extract may be used.

D. Treat in a hot sumac bath as given under A, mordant in an iron bath, so that the garments acquire a medium gray ground, and rinse. Dye in a bath of 122° F., which contains 2 ozs. 10 drachms methyl-violet 6B, and 11¼ drachms methyl or malachite green.

E. *Potash blue.* Work the garments, etc., for half an hour in a cold bath, to which have been added 4⅖ lbs. nitrate of iron and 8½ ozs. tin salt. Dye them for half an hour in a hot bath of 26½ ozs. yellow prussiate of potash, and then add to the bath 7 ozs. sulphuric acid. Return the garments to the bath and work them for one-

quarter of an hour. The same process may be repeated in the iron bath and potash bath.

6. *Bright blue* (22 *lbs.*). Place the garments, etc., for several hours in a bath of 21 ozs. tannin in a clean wooden vessel, and then work them in a bath of $2\frac{1}{5}$ lbs. tin salt for half an hour. Next rinse and dye in a warm bath of $3\frac{1}{2}$ ozs. neutral aniline bright blue.

7. *Ponceau* (22 *lbs.*). A. Place the garments overnight in an extract of $6\frac{3}{5}$ lbs. sumac. Then work them for half an hour in a bath of $17\frac{1}{2}$ ozs. each of alum and tin salt, and let them remain in the bath for one hour longer. Dye in a warm bath of 7 ozs. neutral aniline ponceau.

B. Treat with sumac extract as given under A, and dye at a hand-heat in a bath of $2\frac{1}{5}$ lbs. alum, $3\frac{1}{3}$ lbs. turmeric, and $8\frac{1}{2}$ ozs. diamond-fuchsine.

C. Treat with sumac extract, and mordant with alum and tin salt as given under A. Dye in a decoction of $5\frac{1}{2}$ lbs. Brazilwood.

D. *Turkish red.* Soak the garments overnight in an extract of 10 lbs. sumac. Then place them for two hours in a tin mordant of 5° Bé., prepared by dissolving tin in a mixture of hydrochloric and nitric acids (see below). Dye for one and a half hours in a bath prepared with 22 lbs. best sanders, gradually heating to boiling.

Tin mordant. Pour together $4\frac{2}{5}$ lbs. hydrochloric acid, and from $3\frac{1}{2}$ to 7 ozs. nitric acid, and dissolve in the mixture 7 ozs. of best tin.

8. *Chamois* (22 *lbs.*). A. Dye in a hot bath containing $3\frac{1}{3}$ lbs. annotta and $4\frac{2}{5}$ lbs. soda in solution. Rinse and pass through an alum-bath of $2\frac{1}{5}$ lbs. alum.

B. *Flesh color.* Dissolve 17½ ozs. catechu in the bath, and work the garments, etc., in it for half an hour. Then work them for one-quarter of an hour in a fresh bath of 14 ozs. sulphuric acid, and rinse.

9. *Orange* (22 *lbs.*). Dissolve at a boiling-heat 3⅓ lbs. each of sugar of lead and litharge, and add the solution to a cold bath. Mordant the articles in this bath overnight, and next morning pass them through a lime-bath. Rinse and dye hot in a solution of 26½ ozs. chromate of potassium and 8½ ozs. common salt. Then pass through a boiling-hot bath containing 2⅕ lbs. lime in solution, and rinse thoroughly.

10. *Green* (22 *lbs.*). A. *Bright green.* Place the garments, etc., for two hours in a bath of 21 ozs. tannin, wring out, and bring them for half an hour into a bath of 8½ ozs. tartar emetic. Then dye in a hot bath of 2⅕ lbs. turmeric and 8½ ozs. brilliant green.

B. *May green.* Place the garments, etc., in a sumac bath of 5½ lbs. sumac, in a wooden vessel, allowing them to remain overnight. Next morning mordant them for a few hours in a mordant of 4⅖ lbs. alum and 17½ ozs. sugar of lead. Rinse and dye in a decoction of 6⅗ lbs. quercitron. Blue with 7 ozs. alum and 14 drachms cotton pale blue.

C. *Dark green.* Place the garments in an extract of 8⅖ lbs. sumac, allowing them to remain in the bath for several hours or overnight. Then pass them through a nitrate of iron bath, rinse, work them for half an hour more in the same sumac bath, next for half an hour in a bath of 8½ ozs. tartar emetic, and rinse. Then dye in a bath of 7 ozs. methyl or brilliant green and 2⅕ lbs. turmeric.

D. *Dark green.* Dye medium blue in the cold vat, pass through a quite acid sulphuric acid bath, and rinse. Then mordant for several hours in a hot bath of $2\frac{1}{5}$ lbs. each of bluestone and soda, and rinse. Dye in a bath of $6\frac{3}{5}$ lbs. fustic and $2\frac{1}{5}$ lbs. logwood.

11. *Yellow* (22 *lbs.*). A. *Straw yellow.* Dissolve $4\frac{1}{2}$ ozs. nitrate of lead, add the solution to a cold bath, work the garments for some time in the bath, and then allow them to remain in it several hours. Then take them out and dye in a fresh hot bath of 2 ozs. 10 drachms chromate of potassium. Take them out again, add $3\frac{1}{2}$ ozs. sulphuric acid to the bath, replace the garments, work them for a short time, and rinse.

B. Work the garments, etc., for some time in a bath of $17\frac{1}{2}$ ozs. tannin, then in one of $8\frac{1}{2}$ ozs. chloride of tin, and finally dye at a hand-heat in a bath of 2 ozs. 10 drachms neutral yellow.

C. Dye the garments, etc., for half an hour in a hot bath of $17\frac{1}{2}$ ozs. fustic and $2\frac{1}{5}$ lbs. yellow catechu. Then work them for one-quarter of an hour in a bath of $3\frac{1}{2}$ ozs. chromate of potassium, take them out, add to the bath $1\frac{3}{4}$ ozs. copperas, return the garments to the bath, work them for ten minutes, and dye at a hand-heat in a fresh bath of $1\frac{3}{4}$ ozs. neutral aniline-yellow.

D. *Chrome-yellow.* Dissolve at a boiling-heat $17\frac{1}{2}$ ozs. each of sugar of lead and nitrate of lead, and, after adding the solution to a cold bath, mordant the articles in it for from 12 to 24 hours. Then pass them through a lime-bath, and dye in a hot bath of $26\frac{1}{2}$ ozs. chromate of potassium and $8\frac{1}{2}$ ozs. hydrochloric acid.

12. *Pensée* (22 *lbs.*). A. *Heliotrope.* Place the articles for several hours in a bath of $26\frac{1}{2}$ ozs. tannin, then

work them for half an hour in a solution of 14 ozs. tartar emetie, and, for a blue tone, dye in a bath of $1\frac{3}{4}$ ozs. methyl-violet 6B, or, for less blue tones, in one of the same quantity of methyl-violet 2B or R.

B. *Dark Pensée.* Steep the garments overnight in an extract of $6\frac{3}{5}$ lbs. sumac. Then work them in a nitrate of iron bath at 1° Bé. for one-quarter of an hour, and next in one of 14 ozs. tartar emetic for one-half an hour. Rinse and dye in a warm bath of $3\frac{1}{2}$ ozs. methyl-violet.

13. *Rose-color* (22 *lbs.*). A. The garments, etc., must first be bleached, which is effected by placing them for a few hours in a clear solution of $2\frac{1}{5}$ lbs. chloride of lime, rinsing, passing them through a weak sulphuric or hydrochloric acid bath, and again rinsing. Now work them for one-quarter of an hour in a eold bath of $5\frac{1}{4}$ ozs. saffron extract, then take them out, add to the bath $10\frac{1}{2}$ ozs. tartaric acid in solution, replace the garments, and work them for half an hour.

B. Work the bleached garments, etc., for half an hour in a bath containing $10\frac{1}{2}$ ozs. tannin, and dye in a hand-warm bath containing $5\frac{3}{4}$ drachms of diamond-fuchsine in solution.

14. *Gray* (22 *lbs.*). A. Work the garments in a very weak nitrate of iron bath for 5 minutes, and dye in a decoction of $5\frac{1}{4}$ ozs. powdered nutgalls.

B. Work the garments in a decoction of $17\frac{1}{2}$ ozs. logwood for one-quarter of an hour, and mordant in a bath of 2 ozs. 10 drachms sulphate of iron.

C. Work the garments in a warm solution of $8\frac{1}{2}$ ozs. catechu and $10\frac{1}{2}$ ozs. logwood for half an hour, and

mordant in a bath to which 7 ozs. of acetate of iron have been added.

D. Extract $17\frac{1}{2}$ ozs. sumac and dissolve $8\frac{1}{2}$ ozs. catechu. Add both extract and solution to a hot bath, and turn the garments in it for half an hour. Mordant in a bath with $10\frac{1}{2}$ ozs. copperas.

15. *Cream* (22 *lbs.*). A. Prepare a warm bath of $17\frac{1}{2}$ ozs. barrel soap, and turn the garments in it for half an hour. Then work them in a cold bath of 1 oz. copperas for one-quarter of an hour.

It may here be remarked that the articles intended for light colors have to be bleached according to directions given under No. 13 A.

B. Turn the garments in a weak soap-bath, and dye them for half an hour in a hand-warm bath of $5\frac{1}{2}$ drachms neutral aniline-orange.

C. Pass the garments through a weak soap-bath, and dye in a warm bath of $5\frac{1}{2}$ drachms phosphine.

16. *Mode* (22 *lbs.*). A. Dissolve $17\frac{1}{2}$ ozs. catechu, and add to the solution that of 2 ozs. bluestone. Heat this bath to boiling, and turn the garments in it for half an hour. Then take them out and pass them for half an hour through a bath which contains a solution of $2\frac{1}{5}$ lbs. each of lime and soda. Rinse well.

B. Turn the garments for half an hour in a hot bath containing $17\frac{1}{2}$ ozs. catechu and 1 oz. bluestone in solution; then mordant for one-quarter of an hour in a bath containing $3\frac{1}{2}$ ozs. nitrate of iron and 14 drachms tin salt.

C. Turn the garments for half an hour in a hot bath of 14 ozs. catechu and $1\frac{3}{4}$ ozs. bluestone. Take them out and pass them for 10 minutes at a hand-heat through

a bath of 2 ozs. chromate of potassium. Take them out and add to the chromate of potassium bath 1 oz. verdigris (acetate of copper) and 2 ozs. 10 drachms nitrate of iron. Re-enter the garments and turn them for one-quarter of an hour.

D. Handle the garments in a hot extract of $2\frac{1}{5}$ lbs. sumac for one hour, and then in a nitrate of iron bath. Rinse and dry with neutral aniline Bismarck or orange.

17. *Olive* (22 *lbs.*). A. Turn the garments, etc., for half an hour in a hot decoction of $2\frac{1}{5}$ lbs. quercitron and $17\frac{1}{2}$ ozs. alum, then treat them for half an hour in a bath of $17\frac{1}{2}$ ozs. copperas, and rinse.

For a dark color, $4\frac{2}{5}$ to $6\frac{3}{5}$ lbs. quercitron may be used; or add, according to the shade desired, fustic and log-wood to the quercitron bath.

B. Dissolve $17\frac{1}{2}$ ozs. catechu and $1\frac{3}{4}$ ozs. bluestone. Turn the garments in the hot solution for three-quarters of an hour, take them out, draw them through a weak nitrate of iron solution for one-quarter of an hour, and rinse.

Now add to the catechu bath a decoction of $17\frac{1}{2}$ ozs. quercitron, and dye the garments in it.

C. Turn the garments, etc., in a hot decoction of $4\frac{2}{5}$ lbs. sumac, and then let them stand in it overnight. The next morning turn them for half an hour in a mordant of $17\frac{1}{2}$ ozs. alum and 4 ozs. 6 drachms nitrate of iron. Rinse and replace them in the sumac bath, to which a decoction of $26\frac{1}{2}$ ozs. fustic has been added. After turning them in this bath for half an hour, return them to the mordanting bath, and rinse.

D. Treat in the same manner as given in the preced-

ing, but add to the catechu bath a decoction of 21 ozs. quercitron.

E. *Olive-brown.* Treat in the same manner as given under B, but add to the dye-bath 26½ ozs. Brazilwood.

18. *Gensdarme* (22 *lbs.*). Dye the garments medium blue in the vat and boil. Then pass them through a warm bath of 2⅕ lbs. fustic for half an hour, and next through one of 17½ ozs. bluestone for half an hour. Dye with iodine or methyl-green.

19. *All fancy colors on cotton, etc.*, may be produced by proceeding as follows :—

For light colors, the articles, if not white, require bleaching and are then passed through a strong tannin bath for half an hour, and next through a tartar emetic bath for ¼ hour. They are then dyed warm : For *green* with neutral aniline-greens, such as methyl-green, iodine-green, malachite, brilliant green, etc. For *orange*, with neutral orange; *olive*, with orange and green; *blue*, with neutral bright blue (cotton bright blue); *yellow*, with cotton yellow, turmeric, fustic, etc.; *Bismarck and mode for cotton*, with neutral orange, cotton brown, fustic, Brazilwood, and logwood.

For medium colors, draw the garments for a few minutes through a strong sumac bath and then pass them through a very weak nitrate of iron bath. Rinse, pass them through a tartar emetic bath, and rinse once more. Then dye with neutral aniline colors, eventually with fustic, Brazilwood, and logwood.

For Bordeaux : Diamond fuchsine with a little turmeric.

For dark colors : Turn the garments for several hours in a very strong sumac bath, and mordant in a nitrate

of iron bath at 1° B., or in an acetate of iron bath. Then rinse, pass through a tartar emetic bath, and rinse once more. Then dye as given for medium colors.

All vegetable substances impregnated with a tannin mordant take the dye without use of tartar emetic or another mordant, but they then rub off somewhat.

Dyeing Garments and Fabrics of Mixed Fibres.

The dyeing of mixed fabrics is essentially a combination of the separate methods as given for tissues woven of only one variety of fibre, for half-wool—wool and cotton—goods the treatment being, for instance, the same as for these two fibres. The wool is always first dyed and then the cotton, and with fabrics of wool and silk the first is also first treated. The reason for this is that wool must always be handled at a boiling heat, while cotton or silk is dyed at a lower temperature. Furthermore, the wool does not suffer so much from a subsequent dyeing process as silk or cotton, which, if the continued boiling heat required for wool constituted the final process, would lose color, the acid bath especially destroying the wood-dyes on the other fibres. After dyeing the wool, the cotton or silk should be treated at as low a temperature as possible.

There are, however, some coloring-matters with which it is possible to finish both varieties of fibre in one bath, and such combined methods of dyeing are here given.

1. *Black* (22 *lbs.*). *Combined method for wool and cotton.* A. Steep the garments overnight in a weak bath of about 17½ ozs. to 26½ ozs. catechu, at from 122° to

167° F.—an old catechu bath used for dyeing brown will do. The next morning take out the garments and boil them in a bath consisting of $4\frac{2}{5}$ lbs. copperas, $8\frac{1}{2}$ ozs. bluestone, $5\frac{1}{4}$ ozs. argol, and $26\frac{1}{2}$ ozs. Glauber's salt or common salt, all thoroughly dissolved. Then cool off the bath, work the garments in it while gradually heating to boiling, and allow them to boil gently for one hour. Then take them out and let them lie till the next day. Then rinse and dye them in a decoction of $6\frac{3}{5}$ lbs. logwood and $27\frac{1}{2}$ ozs. fustic. Enter the garments in the cold bath and constantly turn them while gradually heating to boiling. The cotton-thread will now be black, and the garments are gently boiled until the woollen-thread also appears black, which will require from 5 to 10 minutes.

Special care must be taken not to boil the garments longer than absolutely necessary, otherwise the dye is boiled off again from the cotton. With careful treatment, this method produces on half-woollen articles nearly as fast and beautiful a black as when each variety of fibre is dyed by itself.

The garments are finally taken out, allowed to cool, and rinsed.

B. Steep the articles overnight in a bath of $27\frac{1}{2}$ ozs. yellow catechu and $17\frac{1}{2}$ ozs. red catechu. Then take them out and enter them, at 145° F., in a bath of $12\frac{1}{2}$ ozs. chromate of potassium, $10\frac{1}{2}$ ozs. bluestone, $3\frac{1}{2}$ ozs. argol, and $27\frac{1}{2}$ ozs. Glauber's salt. Turn them in the bath while gradually heating the latter to the boiling-point and then let them boil for one hour longer. Now take them out and let them lie till the next morning, or at least a few hours. Then rinse and dye in a decoc-

tion of 7⅘ lbs. logwood. Enter the garments in the cold bath; constantly turn them while gradually heating to boiling, and then boil gently until the wool appears black.

Combined method for wool and silk. C. Steep the articles for one hour in a strong acetate of iron bath and then dye the wool black according to directions given under "Dyeing woollen goods," No. 1 D. After dyeing, pass the articles through a weak sulphuric acid bath, rinse, and, after treating them in a chlorine bath, rinse again.

2. *Brown* (22 *lbs.*). *Combined method for wool and cotton.* Steep the garments, etc., overnight in a bath containing 2¾ lbs. catechu and 5¼ ozs. bluestone in solution. Then take them out and boil them for one hour in a bath of 8½ ozs. chromate of potassium and 17½ ozs. each of argol and Glauber's salt. Dye with a decoction of 2⅕ lbs. fustic, 4⅖ lbs. Brazilwood, and 17½ lbs. logwood. Enter the garments in a cold bath; turn them well, while gradually heating to boiling, and then allow them to boil gently for a quarter of an hour.

3. *Gray* (22 *lbs.*). *Combined method for wool and cotton.* Dissolve in a decoction of 8½ ozs. sumac and 17½ ozs. logwood, 5¼ ozs. alum, 3½ ozs. argol, and 12¼ ozs. copperas. Enter the garments at a hand-heat and work them for half an hour, while gradually heating to 190° F. Then take them out and rinse.

4. *Violet-gray* (22 *lbs.*). *Combined method for wool and cotton.* Turn the garments for a half-hour in the hand-warm solution of 2½ ozs. tannin, and then pass them through a very weak nitrate of iron bath. Rinse

and dye at a hand-heat in a solution of $5\frac{3}{4}$ drachms methyl-violet.

5. *Silver-gray* (22 *lbs.*). *Combined method for wool and cotton.* Boil the garments for half an hour with $1\frac{3}{4}$ ozs. chromate of potassium and $3\frac{1}{2}$ ozs. argol, and then dye with $3\frac{1}{2}$ ozs. each of logwood and archil. Enter the garments in the cold bath, and constantly turn them while gradually heating to 190° F. Then take them out and rinse.

6. *Pensée* (22 *lbs.*). *Combined method for wool and cotton.* Turn the garments, etc., for half an hour in a strong sumac bath, and then let them lie in it for one hour or longer. Now wring them out and work them for half an hour in a solution of $17\frac{1}{2}$ ozs. mordanting salt. Then draw them through a weak sulphuric acid bath and rinse. Next dye in a hand-warm bath containing a solution of 7 ozs. methyl-violet 6B and rinse.

7. *Green and gensdarme blue. Combined method or wool and silk.* Turn the garments in a bath of indigo-carmine, picric acid, alum, and sulphuric acid. Enter at 122° F., and gradually heat to 190° F.

In the following a few directions for dyeing half-woollen goods, when each kind of fibre is to be dyed by itself, are given :—

8. *Black* (22 *lbs.*). After dyeing the wool in the garments black, according to any of the directions given under "Dyeing woollen goods," the garments are steeped overnight in a cold decoction of $4\frac{2}{5}$ lbs. sumac, when they are taken out and turned for two hours in an acetate of iron bath at 2° Bé. They are then thoroughly rinsed and turned for one-quarter of an hour in a cold

bath of $1\frac{3}{4}$ ozs. chromate of potassium. Finally dye in a cold decoction of $4\frac{2}{5}$ lbs. logwood and $17\frac{1}{2}$ ozs. fustic.

9. *Brown* (22 *lbs.*). A. After dyeing the wool in the garments brown, according to the directions given under "Dyeing woollen goods," steep the garments, etc., overnight in a cold decoction of $4\frac{2}{5}$ lbs. sumac, when they are taken out, turned for a quarter of an hour in a nitrate of iron bath at 1° Bé., and rinsed. Now pass them for one-quarter of an hour through the old sumac bath, and then work them for half an hour in a cold bath of $8\frac{1}{2}$ ozs. tartar emetic. Dye at a hand-heat in a solution of $5\frac{1}{4}$ ozs. vesuvine and $3\frac{1}{2}$ ozs. diamond-fuchsine.

B. After dyeing the wool, turn the articles one-quarter of an hour in a cold bath containing $5\frac{1}{2}$ lbs. catechu and $5\frac{1}{4}$ ozs. bluestone in solution, and then let them lie in the bath for several hours or overnight. Then take them out, pass them for one hour through an acetate of iron bath, at 2° Bé., and rinse thoroughly. Now handle them for half an hour in a bath of $10\frac{1}{2}$ ozs. chromate of potassium heated to 167° F., then rinse, and dye in a hand-warm bath of $3\frac{1}{2}$ ozs. vesuvine and $27\frac{1}{2}$ ozs. logwood.

C. After dyeing the wool, give a catechu bath as described under B. Then turn the garments for half an hour in a bath of $8\frac{1}{2}$ ozs. chromate of potassium heated to 122° F., and rinse. Now turn them for two hours in an acetate of alumina bath at 2° Bé. (see "Dyeing cotton and linen fabrics," No. 2). Rinse and dye in a warm bath of Brazilwood, fustic, and logwood.

10. *Marine-blue* (22 *lbs.*). A. After dyeing the wool, steep the garments overnight in a sumac bath. Then take them out, turn them for half an hour in a nitrate of iron bath at 1° Bé., and rinse. Turn them again for half an hour in the sumac bath, and then handle them for half an hour in a bath of $8\frac{1}{2}$ ozs. tartar emetic. Rinse and dye in a cold bath containing $5\frac{1}{4}$ ozs. neutral dark blue.

B. After dyeing the wool, give a sumac bath as above, and then turn the garments for half an hour in an acetate of iron bath. Rinse thoroughly, return to the sumac bath, and handle them in a tartar emetic bath as above. Finally dye in a bath of $1\frac{3}{4}$ ozs. each of neutral fast blue and methyl-violet 5B, or, instead of fast blue, 14 drachms brilliant green.

11. *Bordeaux* (22 *lbs.*). After dyeing the wool, steep the garments several hours or overnight in a bath of $4\frac{2}{5}$ lbs. sumac, pass them through a tartar emetic bath, as given under 10 A, rinse, and dye at 100° F. in a bath of $8\frac{1}{2}$ drachms vesuvine and $1\frac{3}{4}$ ozs. diamond-fuchsine.

12. *Green* (22 *lbs.*). A. *May green.* After dyeing the wool, pass the garments through a sumac bath and tartar emetic bath, as given under Bordeaux. Then dye with $2\frac{1}{5}$ lbs. turmeric and $3\frac{1}{2}$ ozs. brilliant green. Scald the turmeric by itself, dissolve the brilliant green with the assistance of heat, and add both to the cold bath.

B. *Russia green.* Steep the garments overnight in a strong sumac bath, then turn them for half an hour in a nitrate of iron bath and rinse. Next turn them for half an hour more in the sumac bath, and pass them, as above, through a tartar emetic bath. Rinse, and dye in a cold bath of $5\frac{1}{4}$ ozs. methyl-green.

13. *Half-woollen cloth articles.* After dyeing the wool, pass the articles for 10 minutes through a cold, strong sumac bath, and then for the same length of time through a strong iron bath. Rinse, and dye for a short time in cold baths containing a decoction of the dye-wood corresponding to the color desired. Rinse again, and pass through a cold bath containing a *very small* amount of Javelle water—chloride of lime with soda. Rinse again, and, in case the color has been dyed on the wool with acid, the articles may be taken through a weak acid bath. Articles thus treated do not discolor.

14. *Changeant.* Though very seldom demanded, it is of interest to dye half-woollen articles two contrasting colors, for which short directions will here be given. Only half-woollen goods in which wool and cotton are uniformly represented can be used for the purpose.

The wool, in this case, is also first dyed. The coloring-matters for this mode of dyeing must be very carefully selected, so that in dyeing one fibre the other remains, if possible, entirely free from coloring-matter.

A. *Black and white.* The woollen-thread is dyed castor-black—see "Dyeing woollen goods," No. 1 D. The garments are then passed through a weak bath of Javelle water, so that the cotton-thread appears white. Finally blue slightly with methyl-violet.

B. *Cream and rose-color* are produced as follows: The wool-thread is dyed cream with picric acid, and, after rinsing, the cotton-thread is dyed rose-color with saffron extract and tartaric acid in a cold bath, whereby the cream is not injured.

In the above-mentioned black and white (A), the white may also be dyed rose-color with saffron extract.

C. *Brown and green, as well as olive,* may be produced by dyeing the woollen-thread medium brown with archil and turmeric, using as much of the latter as possible, so that the cotton-thread becomes yellow. Now pass the articles through a sumac bath, then through an iron bath, and dye in a cold bath with methyl-green. For olive add diamond-fuchsine.

15. *Sizing.* It is generally supposed that but little sizing should be used. However, there can be no doubt that by a suitable sizing the garments acquire an external appearance which makes the fabric appear more costly, but starch alone, as is frequently done, should not be used for the purpose.

As a normal sizing may be recommended: Joiner's glue 2 parts and wheat-starch 1 part.

Soak the glue in water for one day, and then boil it thoroughly with the starch. With this size the garments may be thoroughly treated without becoming hard, as is frequently the case with the employment of a small quantity of starch alone.

For light colors very pale glue or gelatine should be used. For silk, the finer varieties of gum are recommended.

17. *To free plush after dyeing from fibres.* Plush takes up in the dye-bath many impurities, especially fibres, which are difficult to remove. This may, however, be effected by treating the plush with sand-paper, which should not be too fine. Take a small wooden block of such size that it can be held in the hand like a brush. Round off the lower side and cover it with sand-paper. With the block thus prepared rub off the plush.

VIII.

PREPARATION OF VARIOUS SOAPS AND COMPOUNDS FOR THE REMOVAL OF STAINS.

1. *Ox-gall soap.* I. Open and express sufficient ox-gall bladders to obtain 35 quarts of gall, pour upon 32 quarts of it $7\frac{3}{4}$ ozs. of acetic ether (which amounts to about 7 parts of acetic ether to 1000 parts of gall), and stir for a few minutes. The gall when taken from the bladder diffuses a strong odor, which it loses on the addition of acetic ether. The gall thus purified is converted into soap by treating it with caustic lye, but the product thus obtained is not so good as that produced by melting 1 part resin or tallow soap in $\frac{1}{2}$ part purified ox-gall. This soap is very useful for scouring, it acting in the same manner as the gall by itself, and being more convenient to handle. It can, of course, only be used for colors which will stand it.

II. Mix together $3\frac{1}{3}$ lbs. ox-gall with 55 lbs. melted cocoanut oil. Saponify this mixture by the cold process with $27\frac{1}{2}$ lbs. caustic lye of 38° Bé. The soap may be dyed by the addition of 30 ozs. ultramarine, and, if desired, perfumed with a mixture of $2\frac{1}{2}$ ozs. of lavender oil and $2\frac{1}{2}$ ozs. of caraway-seed oil.

III. Purified ox-gall 1 part, white curd soap 2 parts. Cut the soap into shavings and melt it in the ox-gall at a moderate heat. Evaporate to the proper consistency. The ox-gall is prepared by boiling it with 10 to 12 parts of wood-spirit and straining.

2. *Erasive soap to remove stains and grease from clothing.* Dissolve 2 lbs. good Castile soap and $\frac{1}{2}$ lb. carbonate of potash in $\frac{1}{2}$ pint hot water. Cut the soap in thin slices; boil the soap with the potash until it is thick enough to mould into cakes. Add alcohol 1 oz., camphor $\frac{1}{2}$ oz., hartshorn $\frac{1}{2}$ oz. Color with $\frac{1}{2}$ oz. pulverized charcoal.

Soap for removing stains. Take 22 lbs. of the best white soap and reduce it to thin shavings. Place it in a boiler together with about 1 gallon of water and $18\frac{1}{4}$ lbs. of ox-gall. Cover the boiler and allow it to remain at rest overnight. In the morning heat up gently and regulate it so that the soap may dissolve without stirring. When the whole is homogeneous and flows smoothly, part of the water having been evaporated, add turpentine $\frac{1}{2}$ lb., benzine 7 ozs., and mix well. While still in a state of fusion color with green ultramarine and ammonia; pour into moulds and let stand a few days before using.

4. *Cleansing fluid.* Camphor 8 parts, alcohol 1, sulphuric ether 1.

5. *Cleansing fluid for coarser fabrics.* Mix 1 part ether with 9 parts oil of turpentine.

6. *Cleansing fluid for leather and tissues.* Ether 1 part, oil of turpentine 4 parts.

7. *Winkler's cleansing fluid.* Mix petroleum ether 1 part, sulphuric ether 1 part, absolute alcohol 1 part, and add to the mixture a few drops of a sweet-scented oil.

English cleansing fluid for removing acid, resin, wax, tar, and grease-spots, consists of 100 parts by weight of 95 per cent. alcohol, 35 of liquid ammonia of specific gravity 0.875, and 15 of benzol. The fluid is

prepared by weighing out the benzol, introducing it into a glass vessel, then adding the alcohol, shaking, and finally adding the liquid ammonia.

9. *Scouring water.* Mix rectified oil of turpentine 8 parts, absolute alcohol 1 part, and sulphuric ether 1 part, with a few drops of lemon oil. Shake thoroughly and keep in a well-stoppered bottle. With this fluid grease-stains can be removed without the color of the fabric suffering any change.

10. *Ox-gall scouring water.* Mix together in a glass bottle 4 parts warm water, 3 parts white-soap shavings, ½ part pulverized soda, and 1 part ox-gall, adding the latter when all the rest is uniformly dissolved. To give the mixture an agreeable odor some lavender-water is generally added.

For use, carefully apply a small quantity of the mixture to the stain and brush with a small brush. Then wash with warm water until every trace of the scouring water has been removed, otherwise the fabric might suffer injury. This scouring water should not be used for difficult or fugitive colors.

11. *Scouring water to remove rust-spots from linen, etc.* Mix in a bottle saccharic acid 1 part, lemon-juice 1 part, and pure water 8 parts. Apply a few drops of the solution to the stain, and hold the portion of the linen, etc., containing the stain against a tin vessel filled with hot water. The stain disappears immediately. Finally, wash in soap water.

12. *Cloth cleaning compound.* Glycerine 1 oz., sulphuric ether 1 oz., alcohol 1 oz., water of ammonia 4 ozs., Castile soap 1 oz. Mix together and add sufficient water to make 2 quarts.

13. *Lightning eradicator.* Strong water of ammonia 4 ozs., water 2 quarts, saltpetre 1 oz., finely-shaved mottled soap 2 ozs. Mix thoroughly and allow the preparation to stand several days before using. Cover any grease-spot with this preparation, rub well, and rinse with clean water.

14. *Grease extractor.* Take fuller's earth made free from all gritty matter by elutriation with water. Mix with ½ lb. of the earth, thus prepared, ½ lb. each of soda and soap, and 8 yolks of eggs well beaten up with ½ lb. purified ox-gall. The whole must be carefully triturated upon a porphyry slab, the soda with the soap in the same manner as colors are ground, mixing in gradually the yolks of eggs and the ox-gall, previously beaten together. Incorporate next the fuller's earth by slow degrees until a uniform thick paste is formed, which is made into balls or cakes of a convenient size and laid out to dry. A little of this detergent being scraped off with a knife, and made into a paste with water, and applied to the stain, will remove it.

15. *Le Clerc's scouring liquid* for scouring and removing grease from tissues of all kinds and worn clothes. To take out spots, the liquid is used pure; but for general scouring it is mixed with 4 or 5 times its own quantity of water. Dissolve in 22 gallons of hot water 15½ lbs. white Castile soap, $1\frac{3}{10}$ lbs. carbonate of potash, or 15 or 18 lbs. soft soap. To the solution add extract of Panama $1\frac{1}{10}$ lbs. In another vessel mix ox- or sheep-gall 15 quarts and ammonia at 22° Bé. 3 pints. Heat this mixture, skim it, let it cool, and then add alcohol at 90° $3\frac{3}{10}$ gallons; decant and filter. Take ⅓ part of the soap mixture and ⅔ part of the gall mixture, and add some aromatic essence.

16. *Scouring balls.* I. *Brown scouring ball.* Reduce 2 ozs. Venetian soap to fine shavings, moisten them with a little water and work them in the hand to a paste. Then add 2½ drachms of finely-pulverized calcined copperas, 2½ drachms of finely-pulverized red bole, and ½ drachm lampblack. Mix the substances with 10 drops of water of ammonia and make them into balls, which are laid out to dry at a moderate heat. For use, moisten the stain with water, then rub with the scouring ball, and, when the spot is dry, wash with soft water. Repeat the process twice or three times, and rub the fabric with a linen cloth.

II. *Green scouring ball.* Knead 2 ozs. Venetian soap reduced to fine shavings in the hand to a paste, and add 2½ drachms pulverized verdigris, 2½ drachms tartar, and, finally, 15 to 20 drops of filtered lemon-juice. Now thoroughly mix the constituents together, form the mass into balls, and dry the latter at a moderate temperature. For the removal of stains proceed as above.

III. *Dry scouring ball.* This serves chiefly for the removal of grease, oil, wax, and dust-spots. Pour 8½ drachms 96 per cent. alcohol over 1 oz. each of white clay and pulverized bole, knead to a paste, and form into balls. Scrape or rub some of the ball upon the stain, place a clean cloth upon it, pass a hot iron over it, and brush. Repeat the operation twice or three times.

IV. *Scouring ball for silk garments and fabrics.* Mix 17½ ozs. ordinary soap, 8½ ozs. ox-gall, and 1¾ ozs. oil of turpentine.

V. *Scouring ball for pitch-, wax-, and oil-paint spots.* Thoroughly mix 2 ozs. white soap, 8½ drachms pure

potash, and 4½ drachms juniper-berry oil. Form the mass into balls.

VI. *Scouring ball for resin and grease-spots.* Soap 35 ozs., white bole 15 ozs., and oil of turpentine 5 ozs., are formed into balls with a sufficient quantity of spirits of wine.

VII. *Black scouring ball.* Reduce 2 ozs. Venetian soap to fine shavings, moisten with soft water, add 1¼ drachms lampblack and 10 to 12 drops of potash solution. Now thoroughly knead the mass and form it into balls. Use in the same manner as I.

VIII. *Scouring ball with yolk of egg.* Add to 4¼ ozs. soap, dissolved in spirits of wine, the yolks of 4 eggs and 8½ drachms turpentine. Then add to the mass sufficient magnesia to allow of it being formed into balls.

IX. *Scouring ball for grease-spots.* Triturate upon a porphyry slab 17½ ozs. pipe-clay, free from sand, 17½ ozs. calcined soda, and 17½ ozs. pulverized soap, with a mixture obtained by well beating up the yolks of 16 eggs with 17½ ozs. ox-gall. Make the mass into balls, which are dried at a moderate heat.

X. *Scouring ball for vinegar and wine-spots.* White soap 65 parts by weight, oil of turpentine 10, water of ammonia 5. Treat in the manner previously described.

17. *Soap for cleansing cloth and tissues.* Boil in a suitable vessel 27½ ozs. soap reduced to fine shavings, 1 oz. turpentine, 4½ ozs. each of ox-gall and spirits of wine, and 1½ quarts water until a paste is formed, taking care that the mass does not boil over. When it has reached the proper consistency, add the yolks of two eggs and stir thoroughly. This soap paste must be kept in a cool place.

Ganteine, a composition used to clean kid and other leather gloves. Curd soap, reduced to small shavings, 1 part, water 3 parts. Mix with the assistance of heat, and stir in essence of citron 1 part.

Saponine. This preparation is also used for cleaning gloves. Soap in powder 250 parts, water 155 parts. Dissolve with the assistance of heat. Cool, and add Javelle water 165 parts, water of ammonia 10 parts, and rub the whole to a smooth paste.

For use, a small portion of either the ganteine or saponine is rubbed over the glove with a piece of flannel (always in one direction) until it is sufficiently clean.

IX.

DETERMINATION OF FAST AND FUGITIVE COLORS, AS WELL AS OF THE VARIOUS TEXTILE FIBRES.

THE fibres, of which a tissue is composed are most rapidly and best determined with the assistance of the microscope, which, however, requires considerable experience and skill in the use of that instrument. But chemistry has also furnished us many reliable methods of testing, which are readily executed.

Cellulose forms the basis of all vegetable textile fibres (cotton, flax, hemp, etc.), and they, therefore, vigorously resist the action of even boiling-hot aqueous solutions of the caustic alkalies, while they are strongly attacked by heated sulphuric, nitric, and hydrochloric acids, either in a concentrated or diluted state. Thus, for instance, a cotton fabric may, without suffering great injury, be

immersed in cold water containing 5 to 10 per cent. of acid; but on heating the fluid, especially to the boiling-point, the cotton in a short time becomes friable, and dissolves.

Fuming nitric acid, or a mixture of nitric and sulphuric acids, does not dissolve the vegetable fibre but converts it, almost without changing its physical appearance, into gun-cotton.

Water of ammonia, either at the ordinary or a raised temperature, produces no effect upon cotton and hemp. However, a solution of ammonio-oxide of copper (Schweitzer's reagent) dissolves cotton, hemp, and flax.

In a pure state, vegetable textile fibres have but a feeble affinity for artificially-prepared coloring-matters, they being but slightly or not at all dyed by them, and the application of a little soap suffices to remove the dye. They do not evolve a characteristic odor in burning.

Wool, on the other hand, resists the action of even concentrated and hot acids quite well, but is dissolved, especially at a higher temperature, by caustic lyes. Since wool contains sulphur, there is formed by its solution in caustic soda a fluid which contains alkaline sulphide and sulphydrate, which are indicated by a splendid violet tint produced by the addition of nitro-prusside of sodium. Nitric acid imparts to wool an intense yellow color; chlorine and hypochlorites act in a similar manner, they also imparting to wool a yellow color. At the ordinary temperature Schweitzer's reagent has no effect on wool, but when heated dissolves it. When decomposed by heat, wool evolves the characteristic odor of burnt horn. It possesses great affinity for coloring-matters, especially

for those artificially prepared, by which it is readily dyed without a mordant.

Silk, when burned, evolves an odor similar to wool. It is dissolved, especially at higher temperatures, by the above-mentioned acids in a concentrated state. Cold nitric acid colors silk yellow. Acids diluted with water do not act very vigorously upon silk. Concentrated alkaline lyes dissolve it, but the solution does not contain akaline sulphide like that of wool. Silk is changed, but not dissolved, by very dilute alkaline lyes. Water of ammonia produces no effect on it, while Schweitzer's reagent dissolves it. The affinity of silk for coloring-matters is the same as that of wool.

To establish the presence of vegetable fibres (cotton, hemp, flax, jute, etc.) in a tissue consisting of wool and silk, it is only necessary to boil the latter in a test-fluid containing $3\frac{1}{2}$ ozs. solid caustic soda in one quart of water. Weigh out accurately $\frac{1}{2}$ to 1 drachm of the fabric to be examined; introduce this sample, together with $\frac{1}{10}$ quart of the soda-lye, into a porcelain casserole of about 1 pint capacity, and boil it over an alcohol or gas flame for five minutes. If the mass dissolves, it consists only of animal fibre (silk or wool); but if it is not entirely dissolved, take the casserole from the fire, allow to settle, pour off the supernatant lye, and, after adding fresh lye, boil again for five minutes. If a residue now remains, it consists entirely of vegetable fibre. If the vegetable fibre is colored, the residue is brought upon a small cotton filter and washed with hot water. The washed fibre is then brought into lukewarm water acidulated with about 5 per cent. hydrochloric acid. After ten minutes add a little chlorine-water, or a few drops

of chloride of lime solution, whereby the vegetable fibre is bleached. The filtrate of the caustic soda solution, which contains wool or silk, may now immediately be tested as to the presence of wool. If the latter is present, alkaline sulphides have been formed, which remain in the solution. They can be immediately detected by the addition of a few drops of acetate of lead solution. If a white precipitate is formed, which is completely dissolved on shaking, silk only is present; however, if a black precipitate of sulphide of lead is formed, the tested tissue contains wool. Instead of acetate of lead solution, a few drops of nitro-prusside of sodium solution may be used, which, as previously mentioned, produces in the presence of alkaline sulphides a beautiful violet tint.

If the tissue is provided with much coloring-matter, E. Kopp recommends to cut the sample into small pieces and immerse the latter, with occasional stirring, for five minutes in a mixture of 2 volumes sulphuric acid of 60° Bé. and 1 volume fuming nitric acid of 60° Bé. By this means the wool, silk, and coloring-matters are oxidized and destroyed, while the vegetable fibre is converted into gun-cotton, and retains its characteristic fibrous nature. The whole is then brought into a comparatively large quantity of water, in which the gun-cotton deposits. The fluid is then poured off, while the residue is collected upon a filter, thoroughly washed, and dried. The dry residue now shows the explosive property of gun-cotton.

For testing white, or not too dark-colored mixed tissues, the affinity of the animal fibres for the artificially-prepared coloring-matters may also be utilized. Dark-colored tissues must first be decolorized by treatment

with weak chlorine-water, and subsequent thorough washing in boiling water. Certain precautions have, however, to be observed, since cotton, especially when impregnated with amylaceous or other substances serving for sizing, may also be dyed with aniline colors. These substances must first be removed, and for this purpose the tissue is first boiled for ten minutes in water which contains in 100 parts 2 parts of carbonate of soda and a little soap. The tissue is then rinsed in hot water, next steeped for five to ten minutes in water of 120° to 140° F., which contains 2 per cent. of hydrochloric or sulphuric acid, and finally thoroughly washed. In the meanwhile prepare a dye-bath, by, for instance, dissolving a few drachms of fuchsine in 25 to 30 cubic centimetres of water, heating the solution to boiling, and adding, during the boiling, caustic soda solution, drop by drop, until the bath shows only a pale rose color. Now remove the bath from the fire and introduce the tissue; take it out after a few minutes, thoroughly wash it in clean water, and dry. The silk and woollen threads will be colored bright red, while the cotton, flax, etc., remain uncolored.

For the detection of silk in wool, or wool in silk, in white or light colored tissues, the presence of sulphur in the wool may be utilized. Prepare a solution of oxide of lead in caustic soda by boiling litharge in the latter and, after settling, pouring off the clear fluid. Immerse the tissue in the latter. In consequence of their content of sulphur the woollen threads immediately become black by the formation of black sulphide of lead, while the color of the silk threads, which contain no sulphur, remains unchanged.

A simple method consists in the use of concentrated acids. Cold nitric acid dissolves silk, while wool is not perceptibly attacked by it. Silk acts in the same manner towards sufficiently concentrated cold sulphuric acid. The last-mentioned acid at the same time frees the wool from vegetable fibres by converting them into gum and sugar.

It is, however, better to immerse the sample of the tissue in cold concentrated hydrochloric acid. The silk is in a short time completely dissolved, while the woollen and vegetable fibres remain behind unchanged. Now add water, collect the unchanged woollen and vegetable fibres upon a filter, and wash thoroughly. As a rule, they must also be decolorized.

Now to distinguish the woollen from the vegetable fibres, treat them either with boiling caustic soda-lye, which only dissolves the wool, or use artificially-prepared coloring-matters, such as fuchsine, aniline-violet, picric acid, which do not dye the cotton if the necessary precautionary measures are taken.

Before subjecting the tissues to a chemical test, it is advisable to free them from their sizing and coloring-matters, the first of which is effected by successive treatment with boiling water, either pure or slightly acidulated, or made alkaline by the addition of carbonate of soda, and the latter by chlorine-water. The tissues are finally carefully washed and dried.

The examination of dyed textile fibres and *tissues*, as well as of *garments in general*, will have to extend to the determination of the dye and its lasting qualities. The tests to be made may be quite complicated and diffi-

cult, especially when the various coloring-matters used in the production of a certain shade are to be determined.

J. Fol, who has paid much attention to testing dyed fabrics as to the principal colors, *blue*, *yellow*, *red*, *green*, and *violet*, gives in the "Moniteur de la Teinture" the following methods of procedure:—

A. Blue.

The principal coloring-matters which have to be considered under this head are: 1. *Blue from logwood.* 2. *Paris or Berlin-blue.* 3. *Aniline-blue.* 4. *Indigo-blue.*

a. Pour over the fabric to be tested in regard to its blue color citric acid solution or dilute hydrochloric acid.

I. If the color passes into red or orange, the *fabric has been dyed with logwood.*

II. If the color does not change, the fabric has been dyed with one of the other three coloring-matters.

b. Immerse another sample of the fabric in chloride of lime solution.

I. If the color remains unchanged, it is *Berlin-blue.*

II. If decolorization takes place or the fabric acquires a yellowish color, it has been dyed either with *aniline-blue or indigo-blue.*

c. Bring another sample of the fabric into caustic soda solution.

I. If the fabric is immediately discolored or changed in color, it has been dyed with *aniline-blue.*

II. If it remains unchanged, it has been dyed with *indigo-blue.*

B. Yellow.

The principal yellow coloring-matters are: 1. *Rust color* (*ferric oxide*). 2. *Picric acid.* 3. *Turmeric.* 4. *Fustic.* 5. *Weld.* 6. *French berries.* 7. *Quercitron.* For the recognition of the different coloring-matters, the presence or absence of the rust color and of picric acid has first to be established.

I. For this purpose a sample of the fabric to be examined is placed in a weak, slightly acid solution of yellow prussiate of potash, and another sample in a solution of cyanide of potash. The production of a blue coloration establishes, in the first case, the presence of *rust color*, while in the latter case a blood-red coloration indicates the presence of *picric acid.*

II. If no reaction occurs, place another sample of the fabric in a boiling soap-solution (1 part soap to 200 parts water).

a. If the fabric turns reddish-brown and the yellow color is restored by an acid, it is an indication of *turmeric.*

b. If the fabric acquires a dark color, it has been dyed with *fustic.*

c. If the color remains unchanged, the fabric may have been dyed with *weld*, *French berries*, or *quercitron.*

For the purpose of distinguishing these coloring-matters, three samples of the fabric are used.

If, on vigorously boiling one of the samples with sulphuric acid, the color disappear, the fabric has been dyed with *weld;* the other coloring-matters mentioned above are not affected by this treatment.

On boiling another sample with solution of tin salt,

the color changes to orange if the fabric has been dyed with *French berries;* if dyed with *quercitron,* the color remains unchanged or is but slightly altered.

If *annotta* has been used for dyeing, it is recognized by the greenish-blue color which the fabric acquires when immersed in concentrated sulphuric acid, annotta being the only yellow coloring-matter which gives this reaction.

Chlorine discolors the coloring-matter of *quercitron, turmeric, French berries,* and *weld,* while *annotta* resists the action of this reagent.

C. Red.

The coloring-matters which have to be taken into consideration are: 1. *Cochineal.* 2. *The red produced by Brazilwood.* 3. *Madder.* 4. *Saffron-carmine.* 5. *Aniline-red.*

If a red-colored fabric remains unchanged when alternately placed in boiling soap-solution, water of ammonia, lemon-juice, and a mixture of equal parts tin salt, hydrochloric acid, and water, it has been dyed with *alizarine.* If, on the other hand, a change takes place, it is an indication of the absence of madder and of the presence of one of the other four coloring-matters. If the fabric is entirely discolored by soap-water, it has been dyed with *saffron-carmine,* especially if the characteristic shade of the color does not reappear after washing the fabric with water and shaking it with lemon-juice. If the red color reappears, even in a slighter degree, by this treatment, the fabric has been dyed with *aniline-red.* If, on the other hand, the fabric, when

subjected to the same treatment, acquires a yellowish-red or pale-yellow color, it may have been dyed with *cochineal* or *Brazilwood*. To distinguish these coloring-matters, immerse a sample of the fabric in concentrated sulphuric acid: if a beautiful cherry-red color immediately appears, *Brazilwood* has been used, and *cochineal* when the color changes to yellow-orange.

D. Green.

The dyer distinguishes three kinds of green :—

1. *Green, formed by a mixture of yellow and blue.*
2. *Aniline-green from the aldehyde.*
3. *New aniline-green from the methyl iodide.*

Though mixed colors are at present not so much used as formerly, they occur occasionally. The principal colors are :—

1. *Indigo with picric acid.* 2. *Indigo and yellow vegetable coloring-matters.* 3. *Berlin-blue with picric acid.* 4. *Berlin-blue and yellow vegetable coloring-matters.* 5. *Aniline and picric acid.* 6. *Aniline and yellow vegetable coloring-matters.* The blue coloring-matters give the ground-tone of these mixed green colors. Now, since the blue coloring-matters, with the exception of aniline, are insoluble, and all the above mentioned yellow coloring-matters soluble in alcohol, a mixture of aniline-blue and yellow will be at once recognized by the green color which alcohol acquires in treating the fabric with it.

The procedure of recognizing the green coloring-matters is as follows :—

Heat the fabric to be examined with 95 per cent. alcohol in a water-bath for a few minutes.

I. The alcohol is colored yellow and the fabric more or less blue; or

II. The alcohol becomes green and the fabric retains its color, though somewhat less intense.

In the first case *indigo or Berlin-blue* may have been used. Boil the fabric with alcohol, then wash it in clean water, and pour chloride of lime solution over it. If it becomes discolored, *indigo* has been used as the ground-color of the mixture; and if it remains unchanged, *Berlin-blue.* The yellow-colored alcohol may be used for the determination of the yellow color as above mentioned.

In the second case we have to deal with *aniline-green from aldehyde* or *from methyl iodide*, or with *aniline-blue with yellow.* To distinguish these three coloring-matters, boil the fabric with weak hydrochloric acid; if it turns rose color or lilac, the coloring-matter is *aniline-green from methyl iodide.* If the fabric becomes blue and yellow, the coloring-matter is *aniline-blue and yellow;* and if it is discolored or turns yellowish, *aniline-green from aldehyde* has been used in dyeing.

E. Violet.

The principal colors are: 1. *Ordinary aniline-violet.* 2. *Aniline-violet produced with iodine.* 3. *Alkanna-violet.* 4. *Madder-violet.* 5. *Archil-violet.* 6. *Brazilwood-violet.* 7. *Cochineal-violet.*

If, on immersing the fabric in chloride of lime solution, the violet color remains unchanged, it is *alkanna-violet.* If the color of another sample dipped into lemon-juice becomes brighter, one of the two *aniline-violets* is present. If the violet becomes red or yellow,

it is an indication of the presence of one of the other four colors.

If the violet color has been produced with *madder* or *cochineal*, the fabric when immersed in chloride of lime solution, washed in water, and placed in a solution of yellow prussiate of potash, acquires a blue coloration in consequence of the mordant of ferric oxide adhering to it. If this coloration does not appear, the fabric is further examined as follows :—

1. A piece of the fabric dipped in chloride of lime solution acquires a nankeen-yellow color if the coloring-matter is *madder*, and is entirely discolored if the dye be *cochineal*.

2. When *Brazilwood* has been used in dyeing, another sample of the fabric acquires, when dipped in milk of lime, first a gray color, and finally becomes almost entirely discolored ; when dyed with *archil*, the color passes into blue-violet.

3. When a third sample of the fabric is immersed in hydrochloric acid diluted with three times its volume of water and acquires a blue-violet color, which after washing turns somewhat more reddish, *ordinary aniline-violet* has been used in dyeing. If the fabric becomes blue-greenish, and after washing pale lilac or pearl-gray, *aniline-violet produced with iodine* (*Hoffmann's violet, new parma, primula, etc.*) is present.

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