given photographs, although very indistinct, while the azo compound has not yielded to the action of the light.—*Chemical Review.*

OSTRICH FEATHER DYEING.

By PAUL ALEX, Practical Feather Dyer.

It is possible that some of the readers of this journal think that I should write full recipes to accompany all the colors I mention. It would, no doubt, be much more interesting and perhaps profitable to them. But I do not think it would be advisable, and for the following good reasons: First, because there are no two dyers that make colors in the same way. There are not, perhaps, one in ten that would strictly follow the directions; consequently, the result would not be satisfactory, and the recipe (however good) would forthwith be contemptuously condemned. Second, there are no two dyers who use exactly the same brand of colors. For instance, take logwood; how difficult I find it to get two barrels of exactly the same strength. For fully six years all the colors used by me I obtained at one house, and when I began to buy from others I experienced very considerable trouble in getting satisfactory results—not because the colors were unequal in goodness to those I had been using, but because I did not understand and was not familiar with the strength and quality of them. The majority of dealers in colors know no more about the manipulation of ostrich feathers than a child. I am in almost daily receipt of samples of dyestuffs that are invariably guaranteed to produce the most beautiful shades of blues, greens, reds, etc. But I find that I can use but very few of them.

I promised a few months ago to give the readers of this journal the names of all the dyestuffs used by me, and in accordance with that promise I herewith present a full and complete list. With these I claim to be able to make any color that art or nature ever produced. They will be found to be about thirty in number, viz: Logwood, turmeric, fustic, sumac, copperas, bluestone, verdigris, bichromate of potash, extract of orchil, salt tartar, aniline brown, green crystals, cochineal, marine blue (bluish), marine blue (reddish), extract of safflower, solferino, magenta, bengaline blue, bengaline black (this last-named color can, I believe, be found but in one house in the country), picric acid, Nicholson blue, indigo blue, and reddish essence of coffee, which last will, with the aid of acid, produce the most beautiful shades of cream color. Of the thousands of shades there exists not one that cannot be made by the above list of colors.

With the six following colors, viz., turmeric, logwood, bichromate, aniline green, marine blue, and orchil, I can produce over two hundred distinct shades. I would here remark that any good artist ought to be able to produce as good colors by gaslight as by daylight.—*Textile Colorist.*

FEATHER DYEING.

Intense Blue.

This color is a pale blue—it is sometimes, but improperly, called "Gens d'Arm." It is obtained with comparative facility upon soft, hard, or ostrich feather, by an application of indigo-carmin and archil. It is more difficult to produce it upon skins, wings, and birds. Of course, much indigo-carmin and little archil should be used. Often, in order to make blacker, some black varnish is added to either the acidulated bath, or to a separate or unacidulated one. This process, however, is not to be recommended; it is better to add a little more archil, and, at the same time, very little curcuma. Orange Z may also be taken.

Marine Blue.

This is a dull color, more or less violet-tinted. It is obtained from indigo-carmin and lilac (violet is often substituted for this last color). To produce a deeper tint add a trifle more of archil. Even for very pale marine blue, nothing but indigo-carmin and archil are sometimes taken. For a flat feather the violet is employed to advantage. As regards the ostrich, on the contrary, lilac is preferable, for the violet is easier produced, giving a more uneven color than the lilac.

The bath should be acidulated with archil, not with sulphuric acid, that being too powerful. When the feather is in the boiling bath, indigo-carmin is first poured in, and next a mixture of indigo-carmin and lilac. To deepen the dye archil is added (but in exceedingly small quantities), as it produces considerable efficacy. Time must be given, however, to produce this effect, for it is known that archil bites slowly, and at a comparatively low rate of temperature. If too much archil be taken, it will suffice to give the feather another boiling hot bath with indigo-carmin and violet.

The white ostrich feather of good quality easily takes a marine blue color with indigo-carmin and lilac; but that which has been used a little, and above all the gray, becomes brown, or rusty, almost inevitably, as will be seen when we shall have occasion to speak hereafter of metallic reflects.

The difference in the nature of feathers belonging to one and the same lot is the cause of a very great inequality—some feathers being more reddish or greenish than others—so that after an energetic heating it is well, in drying the feathers, to range them in order of tint, and treat each species separately, boiling the hardest, or those feathers not reddish enough, longest in the original bath, and giving, on the other hand, a boiling hot bath of indigo-carmin to those which are too reddish. This operation being evidently too long, is unfortunately inapplicable to cheap feathers.

For skins, wings, and birds, the same processes are employed. Much precaution must be had that not too much sorrel salt be used, and above all, that the process be effected as quickly as possible.

Plum.

The plum color is a pale violet. The feather is dyed in a bath acidulated with sulphuric acid, archil, indigo-carmin, and black gloss, so that an almost black garnet may be produced. It is well to add a little lilac. The feather is taken out of the bath only at this moment. It is rinsed in pure water and then given a violet tint in a more or less heated solution of carbonate of soda. During this operation the archil turns from red to violet. Black is developed and settles more firmly on the feather, while a large portion of the indigo-carmin goes off. It is a primitive process, and certainly not economical, but which, nevertheless, gives good results in skilled hands, but in the hands of unskilled operators it is extremely tiresome and of doubtful success.

Second Process.

This is a direct process. Plum, which is but an impure

pale violet employed in a bath acidulated with acetic acid, is taken for it. The dye is deepened with grayish-blue or grayish-rose, according to the tint required. When a blue shade is desired, lilac is added to it; if on the contrary, then red eosine is added. This process, which is fairly successful in light plum, is more difficult of application in dark plum. When, then, a well-nourished plum is required, recourse must be had to the first described mode.

Gray.

There are a great variety of grays, resulting invariably from the mixing of any given color with black and white. It would be well-nigh impossible to describe them all; and as it would also be unprofitable, I shall limit myself to the principal kinds.

Pearl gray is a mixture of violet-tinted blue, with very little black and much white. It is obtained by the same process that serves to make white—that is to say, by a mixture of indigo-carmin and violet. I shall not now return to a description of this procedure, and shall only state that in the personation of pearl gray the quantities of the coloring matters employed are somewhat augmented.

Giselle gray is a mixture of white with black. It is easily obtained by dyeing the feather with a small quantity of gloss black. As there is always a residue of yellowish hue it becomes necessary to give it a ro-e color with cochineal. This operation is effected in a cold bath, acidulated with a small quantity of salt of sorrel. If it be an ostrich feather, starch is dissolved in it.

Silver gray is a mixture of white and blue tarnished with black in very small proportion.

Silver gray is obtained by employing roseate gray and blue gray in convenient proportions. These coloring matters are employed much diluted in a clear solution, and an acidulated bath is prepared with acetic acid or sorrel salt. The bath should be cold and, for an ostrich feather, contain starch; it should be simply cold or tepid if a tender feather is to be dyed, and a boiling heat in the case of hard feather.

Felt gray is a yellowish gray. It may be obtained in different ways; the following two being the principal ones:

First Process.

In a bath acidulated with sorrel salt or sulphuric acid the feather is first steeped; gradually a solution augmented with an extract of chestnut-bark is poured into same, alternating with a second solution of violet. According to whether the sample has a more greenish or roseate tint, archil juice or water rendered blue with indigo-carmin is added.

Sometimes, in order to produce a deeper dye, gloss black is also added; this is, however, attended with the inconvenience of producing a color that will rapidly change as soon as brought into contact with the air. In such a case it will be better to employ, jointly with the extract and the violet, rose-colored gray.

The procedure which we have just described is very old, particularly if gloss black is taken. It is, however, attended with some serious disadvantages.

First.—Difficulty of application, for one requires to be very clever to dye rapidly and well in this manner.

Second.—The extract of chestnut bark never gives a perfect equality, and when taken in too large quantities prevents the feathers from being restored in the drying process.

Second Process

Is more recent than the preceding one, and every way preferable. It consists in employing felt gray in connection with rose-colored gray. These two substances, of easy application, will serve for the generality of the tints in question. If it were required to produce a somewhat roseate hue, cochineal or violet might be taken; if, on the contrary, a green one, a very small quantity of indigo-carmin would be required. These coloring substances are applied, according to the feather and the tone of the color, in a cold, lukewarm, or boiling hot bath, acidulated with acetic acid or salt of sorrel.

Iron Gray, Steel Gray, etc.

These kinds of grays are usually rather darkish; the tints result from a mixture of blue, a good deal of black, and some white. They are obtained on the feather by means of a conveniently proportioned mixture of roseate gray and blue gray, the shade being subsequently imparted, as in the case of the other gray species.—*Textile Colorist.*

COSMOS FIBER OR VEGETABLE WOOL.

NOT the smallest of the many triumphs which the science of chemistry has achieved of late, has been added by a new invention, the universal adaptation of which to the textile industries will, no doubt, cause an entire revolution in their various branches. Mr. Anton E. Neumann, a Hungarian manufacturer, has, after many years of research and experimenting, succeeded in discovering a chemical process by which the fundamental difference between vegetable and animal fiber is actually removed. It is well known that the difficulty in simultaneously employing wool and cotton, or other vegetable fibers, for textile purposes, arises from the fact that both materials cannot be homogeneously dyed, spun, or milled. The cause of that difficulty is to be looked for in the different natural structure of the two kinds of fiber; the vegetable fiber being straight, while the animal fiber is curly and crisp. The essence of the new invention is this, that by the agency of certain chemical substances, the vegetable fiber is so efficiently curled, that it permanently retains its altered structure during all manipulations of manufacture, and can be dyed together with wool, and equally fast, by one and the same process. The extreme importance of such an invention is obvious. In the first place, an organic combination of animal and vegetable fibers is at once produced; and secondly, a splendid substitute is found for shoddy and all artificial wools; for this new fiber is not only much cheaper, but excels them all in quality, strength, and durability, and is capable of a far wider application in the manufacture of cloths, blankets, flannels, hosiery, etc., and especially cloth buckskin and all varieties of felt. Hitherto the only representative of the new invention in Europe has been the Cosmos Fiber Company, of Düsseldorf, but its success has been so pronounced, and the interest created so great, that several capitalists are desirous to extend the manufacture into England, France, Belgium, and Algiers. This company will undertake the conversion of the cosmos fiber plants into a material ready for spinning purposes, by subjecting them to a chemical bath, washing, carding, bleaching, or dyeing them, thus producing a substance which, when mixed with wool, may be treated in like manner with it, through every process of manufacture. The results already attained are surprisingly auspicious. Samples of a variety of cloths made wholly or partly from the cosmos

fiber have been shown me, which, in respect to color, fineness, homogeneity, and crispness of fiber, need not fear the severest criticism. Its cost, moreover, is an important item, since it is five times cheaper than wool, and is the only material which can be used in the proportion of 25 to 50 per cent. That is, wool can be mixed with from 25, 33, to even 50 per cent., and yield a fabric resembling all wool, yet good and strong in quality. The above mentioned samples, consisting of two-thirds of fiber and one-third of wool, possess a perfectly blended color, and are of so homogeneous a tissue, that even an expert would, in pulling out the threads, hardly suspect them to contain any vegetable.

The manufacturers and governments of Germany, France, Belgium, and Italy, are taking a lively interest in the invention, which has been patented in those various countries.

At present, the manufacture is confined to the fiber substitute for wool; but a second invention, also patented and the property of the above-named company, is of equally great importance to the textile industries. It touches the utilization in linen and silk manufacture of the so-called ramie or rhea plant (*Urtica utilis*), which grows wild in immense quantities in British and Dutch India, and the French-Algerian colonies. The English Government has long been appreciating the vast importance of that plant, and has offered a premium of £5,000 for the solution of the problem of removing the woody and resinous substances of the plant, which premium, however, has never yet been awarded. That problem seems now to be solved, and I have had shown to me partly prepared rhea stalks, the lower end of which was preserved in its natural state, while the upper prepared part showed a silky, long-stapled fiber of extreme strength, which is capable of being further treated in the same way as flax, etc.

The demand upon the Düsseldorf factory for the cosmos fiber has already assumed large proportions, and during the first months of its working—April 1st to Oct. 1st—the not inconsiderable quantity of 75,000 kilos (75 tons) of bleached and unbleached material was manufactured for spinning purposes. And its value and success are so perfectly assured, that one firm alone has arranged for the delivery of 200 lb. per day—a contract which runs for one year.

What a new perspective, then, is here opened out to the wool, silk, and linen manufactures, which are now presented with a raw material of such surprising cheapness and perfection! No one feeling any interest in the progress and welfare of the textile industries can fail to welcome these inventions, which bid fair to give a great stimulus to enterprise and become a new means of enhancing the national wealth.

ESTIMATION OF NITROGEN.

At a recent meeting of the Chemical Society, London, Mr. Ruffe read a paper "On the Estimation of Nitrogen by Combustion, including the Nitro-compounds." For strictly correct chemical purposes the nitrogen in a substance is estimated by Dumas's method; in analytical practice the process usually employed is the well-known soda lime method of Will and Varrentrapp. It has long been known that with some compounds containing nitrogen this process gives very imperfect results. The author has tried the effect of numerous devices and mixtures, but all yielded results much too low, or were inconvenient. A mixture of sodium hyposulphite and sodium hydrate yielded theoretical results, but had the great objection that it could not be obtained as a powder, only as a wet mass. After many trials the author found that a mixture containing two molecules of sodium hydrate, one molecule of pure lime—from marble—one molecule of sodium hyposulphite—the first two being slaked together, dried, and finely powdered—gave very satisfactory results with all varieties of guano, gunpowder, nitrates of soda, potash, and silver, picric acid, sodium, nitro-prusside, East Indian linseed, milk residues, dried flesh, etc. The author uses $\frac{1}{2}$ in. lap-welded steam piping bored out to $\frac{1}{8}$ in. in 22 in. lengths, for combustion tubing. The substance is mixed with $1\frac{1}{2}$ gm. of a mixture of equal parts of sulphur and wood charcoal, 13 gm. of the above soda lime mixture, and 21 gm. of powdered hyposulphite of soda are weighed off and mixed, 5 gm. of this mixture are placed at the back of the combustion tube, then the mixture containing the substance, then the rest of soda and hyposulphite, finally 18 gm. of ordinary soda lime. The combustion is commenced 4 in. from the front end, and continued gradually until the evolution of gas ceases. It is maintained at a red heat for ten minutes.

DETERMINING PHOSPHORIC ACID.

By DR. B. PEITZSCH, DR. W. ROHN, and DR. P. WAGNER.

THE authors recommend the following process, which has proved satisfactory in the experience of five years.

From 25 to 50 c.c. of the solution of the phosphate, which may contain from 0.1 to 0.15 gramme P_2O_5 , are placed in a porcelain capsule with the addition of 100 to 150 c.c. molybdic solution. The mixture is heated on the water bath, with occasional stirring, to about 80°, set aside for an hour, filtered through a plain filter, and the yellow precipitate (which need not be entirely rinsed on to the filter) is washed with dilute molybdic solution. The porcelain capsule is then placed under the funnel, the filter is pierced with a platinum wire, and the precipitate is washed into the capsule with dilute ammonia ($2\frac{1}{2}$ per cent.), washing the filter paper well, dissolved, stirring with the glass rod, and the solution washed into a beaker with ammonia of the same strength, enough of which is added to make up a volume of 100 c.c. About 15 c.c. of magnesium chloride mixture are then gradually dropped in, constantly stirring. After the mixture has been set aside for two hours, covered with a glass plate, it is filtered through a plain filter, the weight of the ash being known, and the precipitate is washed with dilute ammonia of the same strength till a portion of the filtrate, after being acidulated with nitric acid, does not show the presence of chlorine with silver nitrate. The dried precipitate is separated from the filter, placed in a porcelain crucible; the paper is charred but not incinerated, and the char placed in the crucible, which is heated first gently, then ignited strongly for ten minutes in a slanting position over a Bunsen burner, and finally exposed for five minutes to a blast flame, let cool in the exsiccator, dried, and weighed.

The first 6 or 8 c.c. of the magnesia mixture should be added very cautiously.

The final ignition before the blast serves to volatilize any traces of molybdic acid which may have been precipitated.

The molybdic solution, dilute molybdic solution, and magnesium mixture should be prepared as recommended in the *Zeitschrift für Analytische Chemie*, 12, 289.