part by the magnesia, but the oxygenated water has also a direct action. On boiling a considerable amount of carbon dioxide is evolved, due to the oxidation of glycerol, while the neutral fatty bodies are also acted upon by acidulated oxygenated water with the formation of fatty acids and the evolution of carbon dioxide. The fatty acids themselves are still further oxidized both by the magnesia and by the oxygenated water, and the oleic acid formed is also partially converted into palmitic acid. The fatty bodies remain in the fiber as oleates and palmitates, etc., of magnesia, and are eliminated by treatment with dilute acid and alkali successively. Cellulose is transformed into oxycellulose by oxygenated water, an action which is much aided by the presence of metallic oxides, and also by mercerizing the cellulose beforehand, that is, by adding caustic soda to the bath used. A piece of cloth mordanted with iron, chromium, and alumina was considerably attacked by the oxygenated water in the parts covered by the mordants in 1-2 hours; it is therefore advisable to place the cloth, previously to bleaching it, in a bath of dilute acid, so as to remove any metallic salts or oxides that may be present. An ammoniacal copper solution acts upon cellulose very similarly to oxygenated water, and when employed in dilute solution, so as not to disintegrate the fiber, is found to act as a bleaching agent and to give rise to the formation of oxycellulose. Schweitzer's reagent therefore does really attack cellulose, a fact which is contrary to the generally accepted view of its action.—*Compt. Rend.*, 1891.

FAST BLACK—A PREPARATION OF LOGWOOD.

By H. GUTKNECHT.

FOR some time past, a product obtained by the oxidation of logwood with potassium bichromate has been largely employed in the black dyeing of cotton goods. The following is a recipe for its preparation: To a mixture of 100 kilos. of logwood extract at 25° B. and 25 kilos. crude glycerin there is gradually added with constant stirring an oxidizing solution composed of 8 kilos. of potassium bichromate, 15 kilos. of chrome alum, 50 liters of water, and 12½ kilos. of hydrochloric acid at 20° B. The logwood-glycerin mixture, while undergoing oxidation, is heated to 100°, and this temperature maintained for ¼-½ hour after completing the addition of oxidizing solution. After cooling and allowing to stand for twelve hours, the product, which should be free from any sediment, is ready for use.

For use in cotton dyeing, 3-6 per cent. (of the weight of the cotton) of the above preparation is dissolved in water at 20°, the material to be dyed introduced, and the temperature of the bath raised to 40° in the course of 25-30 minutes.

To render it suitable for printing, the preparation is treated with 12 per cent. of its weight of sodium bisulphite at 40° B., and allowed to stand for about eight days. It yields a good black when printed on calico and steamed.

A cheap black ink may be prepared by diluting the oxidized logwood preparation (1 part) with water (10-15 parts), thickening with glucose, and neutralizing with sodium carbonate (about ½ per cent.).

Glucose may be used instead of glycerin in the above recipe.—*Chem. Zeit.*

ACTION OF LIGHT ON COLORS.

By T. FRUSHER.

THE author has exposed to light for a period of 40 days samples of a number of dyed colors, with the following results: Of the natural coloring matters, camwood, the fastest of the red woods, and fustic, the fastest of the yellow woods, both fade a little; logwood, in pale shades, is considerably decolorized, the destruction of color not being so apparent in dark shades; logwood blacks "finished" with chrome turn greener than unfinished blacks; vat-dyed indigo gives the fastest of all blue colors. Among the artificial coloring matters tested, alizarin blue and anthracene brown, in pale shades, are only moderately fast; galloxyanin is not quite so fast as alizarin blue; naphthol black, diamond black, anthracite black, and other wool-substantive azo blacks are much faster to light than logwood black.

PYROTECHNY.

By T. A. ELLWOOD, A.I.C., F.C.S.

PYROTECHNY treats of the production of fires by combustion. It was discovered by the Chinese, with whom it remained a secret for centuries. Not until the thirteenth century did Europeans discover the property which certain substances possess of imparting color to flame. The manufacture of fireworks has now become a scientific art. Its study necessitated a fair knowledge of organic or inorganic chemistry, a knowledge of metallurgy, and of the fundamental laws of mechanics. In manufacturing there are three important considerations:

Oxidation.—The agents generally employed are chlorates and nitrates, their object being to promote combustion after heat is applied.

Influencing Agents.—Those which regulate the combustion, as sand or potassium sulphate.

The Active Ingredient.—To give the color desired.

Camphor and lycopodium are used in theaters; potassium nitrate with lamp black for golden stars, copper filings for green, and zinc for blue, etc.

Of fireworks there are four kinds: (1) Single—example, the squib; (2) terrestrial—placed on the ground—as mosaics and waterfalls; (3) atmospheric, as the rocket and Roman candle; and (4) aquatic.

COMPOSITION.—*Rocket:* Sulphur, 1 part; carbon (charcoal), 2 parts; nitrate of potassium, 4 parts; meal powder (as a diluent), 1 part.

Roman Candle: Sulphur, 4 parts; carbon, 3 parts; nitrate of potassium, 8 parts.

Pin Wheel: Base—Sulphur, 5 parts; nitrate of potassium, 9 parts; meal, 15 parts. Color as desired.

Beaut Lights (poisonous). Realgar or orpiment, 1 part; black antimony, 5 parts; red lead, 1 part; sulphur, 3 parts; nitrate of potassium, 14 parts.

COLORS FIRES OR STARS.—*Blue:* Chlorate of potassium, 8 parts; calomel, 4 parts; copper sulphide, 5 parts; shellac, 3 parts.

Green: Barium salt, 16 parts; chlorate of potassium, 16 parts; sulphur, 5 parts; charcoal, 1 part.

Yellow: Oxalate of sodium, 2 parts; chlorate of potassium, 4 parts, with shellac.

Mauve: Chlorate of potassium, 28 parts; calomel, 12 parts; shellac, 4 parts; strontium nitrate, 4 parts; copper sulphide, 2 parts; stearin, 1 part.

Purple: Chlorate of potassium, 16 parts; copper sulphide, 8 parts; calomel, 7 parts; sulphur, 2 parts.

Different shades are obtained by slight variation in composition.—*Chem. and Drug.*

CLOISONNE AND CLOISONNE MAKERS IN JAPAN.

ENAMELS, whether they may be those known as champleve, or cloisonne, or the variety which reached its highest perfection in Limoges in the middle ages, have for centuries been sought after by connoisseurs who loved to possess beautiful and costly objects of art, by the devout who would devote them to religious purposes, and by the vain to use for personal adornment. All ages and all countries can furnish relics of this old and beautiful art, and in the tombs of the Homeric heroes at Mycenae, in the jewelry adorning the mummies of ancient Egypt, and in the brooches and tiaras of the old Celtic kings are found exquisite and priceless examples of enameling on copper and gold. It is in fact scarcely possible to mention a period up to the present when enamels were not produced either in the East or in Europe. From the time of Justinian till the middle of the sixteenth century enamels were introduced freely into the elaborate and costly decoration of the reliquaries, crosses, censers, etc., used in the ceremonials of the church, as well as in the ornamentation of girdles and weapons of the nobles and warriors of those days. In the seventeenth and eighteenth centuries the art suffered decadence in Europe, but the wonderful exhibits in the jewelry and orfèvrerie departments of the French section of the great exhibition in Paris in 1889 sufficiently demonstrated that the French at least among the nations of Europe still understand the mysteries of the art of enameling on metals, and can produce champleve and cloisonne enamels as fine as any ever produced in the middle ages in Europe or in the Orient, provided that buyers can be found willing to pay the high prices such costly and artistic work demands in Europe. The hands of European artisans are indeed no less skillful than those of China and Japan, and the artistic minds which direct them can conjure up creations as beautiful as those of the Orient; but the standard of comfort and the cost of living of the European artisan of to-day is so much higher than that of his Eastern fellow worker that high wages have driven many art industries entirely into the hands of the simple-living and humble-minded workers of the East. Thus the making of enamels exists only as an organized industry at the present time in China and Japan.

Among the many art treasures which were brought to light at the sacking of the Summer Palace in Peking in 1859, and which subsequently served as models in European porcelain and pottery factories, and aided in reawakening an enthusiasm for the beautiful products of art industries, were some cloisonne enamels on copper of the Ming dynasty. These are the oldest Chinese enamels extant of which we have any knowledge, and they probably date back from 300 to 600 years. That the Japanese learned the art of cloisonne enamel from the Chinese is not disputed, and the tradition is that one Hirato Hikoshirō by name introduced the art of cloisonne making into Nagoya toward the end of the sixteenth century. Here for 300 years the industry has flourished, and Nagoya is still the place in Japan where there are the largest number of cloisonne workshops, and where Hondo and Shippo turn out a number of the vases and plaques which find their way to Europe.

The process of making cloisonne enamel is simple, minute, and laborious. It is briefly thus. The design is first sketched on the copper surface of the vase or plaque to be decorated. Strips of flexible copper about a millimeter in width are then bent with small pincers to correspond to the lines of the design, and are affixed edgewise on to the copper surface by means of a strong glue cement made from the bulb of an orchid, the *Bletia hyacinthina*. When the cement is dry the cloisons are soldered to the base. It may in certain mechanics, both professional and amateur, to know how the Japanese make their solder. Eight parts of brass, seven of tin, and ten of zinc are melted together. This alloy is then pulverized, and ten parts are mixed with three of borax and sufficient water to make a pulpy paste. This paste is applied with a stick to the parts to be soldered together, and they are heated over a moderate coal fire till the solder melts. With the cloisons thus firmly attached the article passes to the enamelist, who fills up the cells with a material of various colors. In the older Chinese and Japanese enamels the mineral coloring matters were mixed with other ingredients and fused together. This method of working resulted in producing the opaque and dull coloring which some connoisseurs affect to greatly admire. Much of the modern Japanese cloisonne is, on the contrary, singularly pure and transparent in color, and these effects are produced by stained glass being used for fluxing instead of pulverized mineral colors. The glass is ground fine and mixed with water to form a uniform paste. Furnished with little saucers containing the various colored pastes to be used, the worker sits on the floor before a low box table which carries his materials for work, and, dipping an ivory styllet into one or other of the saucers of paste, applies the flux atom by atom to the interior of the cells. When the cells are filled the enamel is left to dry in the open air, and when air-dried is baked in a closed muffle. The enamel shrinks greatly in the oven, and air bubbles and holes appear. The article is then returned to the workshop for the cells to be refilled, and after the second baking it is rubbed down and polished. These successive processes of filling, baking, and rubbing down are repeated several times, till the hard and polished surface is flush with the cell walls, which appear as narrow metal bands separating the various colors and tints of the enamel. The successive polishings are accomplished with different materials—coarse and fine sandstone, slate, and magnolia char-

coal being used after the second, third, and fourth burnings, with rape oil and hartshorn ashes. The last layer of enamel is applied as a thin coating after the final burning and polishing to give luster and brilliancy. In cloisonne enamels representing pictorial effects the metal cell walls are finally covered and buried in the enamel, except where it is considered advisable from the artistic and picturesque point of view to leave them exposed. The master of this special form of cloisonne enamel is Namakawa, of Tokio. Cell enamel on porcelain, for which the Japanese are so celebrated, is produced in the same way as above described, except that the soldering is omitted, which in fact is often also done in copper enameling.

The finest examples of modern Japanese enamels are rarely seen in Europe; they go to America, our cousins across the Atlantic being willing to pay for a gem of workmanship the price which such minute and artistic work demands. The wondrous enamel pictures of Namakawa, of Tokio, seen when I first arrived in Japan at Mr. Deakin's at Yokohama, and at the art exhibition at Tokio, filled me with the desire to see this artist's workshop and to understand how such subtle and pictorial effects were produced by means of a process so apparently intractable as that of cloisonne enamel. By the kindness and courtesy of Captain Brinkley I was enabled to fulfill my wish, to be thus only the second European who had visited the little workshop from which such surprising and delightful art work is turned out. Let me try and realize to you what Namakawa's, of Tokio, cloisonnes are like. I will describe one in the possession of Mr. Lowder at Yokohama. It is a picture about 18 inches by 12 in size, and the subject is a winter landscape. The low rounded hills are covered with snow, from which rise the dark stems and gaunt branches of a few fir trees; the sky tones are from the cold pale blue of a winter's day to the tender pinks of sunset. Below the snow-covered hills is a calm, deep lake, the waters of which have that peculiar cold, steely gray color characteristic of lake water on a snowy day. Across its still surface steals a solitary little skiff. The repose, the tender coloring, the truthfulness to nature, and the suggestiveness of this charming impressionist picture—worked in solid imperishable enamels—are quite delightful, and no one but a Japanese could have conceived and executed it. Take another piece of Namakawa's work which I saw, says Mrs. Hart in the *Manchester Guardian*, in Mr. Deakin's collection at Yokohama, and had photographed. Two pigeons are represented against a background which shades from rosy orange to gray. The fluffy plumage of the birds' breasts, the iridescence of the feathers of the dark pigeon, and the yellow shades of the white one are given with a skill vying with the painter's art. Yet another example from the same interesting collection of all that is best of modern Japanese art. It is a small tray measuring ten inches by five. On the upper surface is represented a goldfish swimming under the water. A flux of transparent bluish enamel incloses and covers the scaly fish, which is exquisitely wrought in pure gold. A few reeds below and a water plant floating on the surface give reality to the illusion. A geometrical design in dull blues, browns, and reds covers the back of the tray. This little gem of workmanship was going to Dr. Williams, of Philadelphia, and cost 75¢. Namakawa's workshop at Tokio, where these objects of art are produced, is simplicity itself. Opening freely by the sliding paper panels on to the pleasant little garden are the rooms where the work of attaching and filling the cells is carried on. About six workmen are in each room. Seated on their heels on the matted floor, they are busy dipping their ivory styllets into the various saucers of colored pastes and applying the atoms of enamel to the cells, thus obtaining, by laborious care and artistic taste, the gradations of tint and tone so much admired in Namakawa's products. The enamels turned out from this little collection of workshops are so good that it is to be regretted that Mr. Namakawa does not always select the best models and designs for his workpeople, but is sometimes content with designs of a lower grade. I do not think he need have any fear but that the best work of which he and his workpeople are capable will always find ready purchasers in Europe and America, and he can leave the production of cheaper qualities and inferior designs to other workshops. Every piece, moreover, that comes from Namakawa's workshop should bear his signature, so that the picture enamels of Namakawa of Tokio should be as well known, as much sought after, and as verifiable as the cameo glass of Galle of Nancy.

As the name of Namakawa of Tokio immediately suggests one kind of cloisonne enamel—the representation of poetic impressionism—so the name of Namakawa of Kyoto suggests a totally different kind of cloisonne enamel, namely, that of intricate formal design and of brilliant coloring. The cloisonne vases seen in the shops of the curio dealers in England are poor imitations of the work of Namakawa of Kyoto, and I do not think that genuine examples of his work are ever offered for sale in England. To see and realize the perfection and delicacy and finish of Namakawa's work a visit must be paid to his workshop in Kyoto. Seated on the matted floor are the workpeople, closely occupied in filling the cells of the objects in their hands with the brilliant enamel pastes which Namakawa holds the secret of making. The spring day is warm and bright, and the paper wall panels of the workshop are slid back, giving a view of the trees and flowers of the garden beyond. After photographing the group of artist workmen in their pleasant airy workroom I stepped out into the sunny garden and passed under the cherry trees powdered over with blossoms of pink and white, across the miniature stone bridge, and around the tiny borders of the tiny lakelet, in the placid waters of which tame golden carp as large as salmon trout floated lazily, and came to be fed by Mr. Namakawa, who, standing on the balcony above, clapped his hands and sprinkled biscuits in the water for his piscatorial pets; and thus I sauntered on through this pleasant little garden, full of poetic suggestions and significant of a life of artistic refinement, which led from factory to showroom. What an ideal factory! No smoke, no noise, no hurry. Engaged in the pursuit of a delightful art, the workmen have but to lift their eyes from their work to see the cherry blossoms tossed up against the blue sky, the stone temple lamp found in every Japanese garden suggest-