UNITED STATES STEAMSHIP IOWA.

In the battleship bearing the above name the United States government will possess a vessel of great power and endurance, fully able to cope with any vessel of her size afloat. She was designed by the Navy Department to meet the requirements of the naval appropriation bill of July 19, 1892, calling for a battleship of about 9,000 tons displacement and not to exceed a cost of $4,000,000, the size and cost being based upon the United States steamships Indiana and Massachusetts now building. The preparation of the design was intrusted by the Secretary of the Navy to Commodores Wilson and Melville, and so well have they performed the task that a vessel 1,000 tons larger than the Indiana is to be built within the same limit of cost. The dimensions of the Iowa are as follows:

Length on load line	360 ft.
Beam extreme	72 " 2½ in.
Mean draught	24 "
Displacement	11,296 tons.
I. H. P.	11,000
Speed, in knots, per hour	16
Coal bunker capacity	2,000 tons.

The main battery consists of four 12-inch breechloading rifles and eight 8-inch breechloading rifles mounted in turrets. The 12-inch gun turrets are armored with solid steel plates of 15 inches thickness, and the 8-inch guns are protected by armor of 8 and 5½ inches in thickness. All this armor is treated by the Harvey process, which gives the plates a casehardened surface, gradually shading off to a soft back.

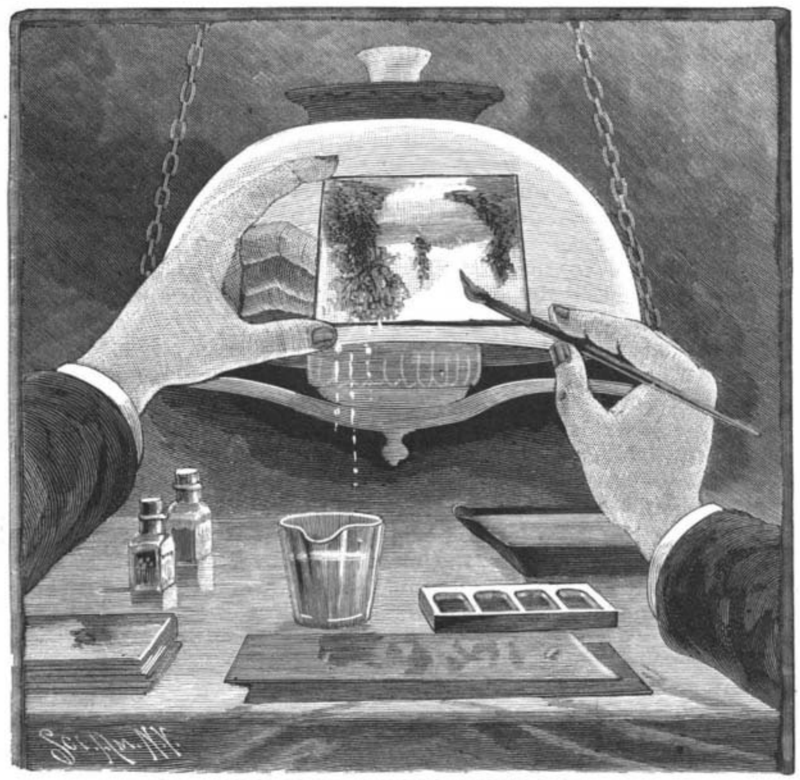
The secondary battery is made up of six 4-inch rapid-fire breechloading rifles. These rifles throw a shell weighing thirty-six pounds, and are capable of being fired ten times per minute. These guns are protected with light armor against machine gun fire, and are disposed so as to have as great a range of fire as possible. The auxiliary battery consists of twenty 6-pounder and nine 1-pounder machine guns, with six torpedo tubes.

The protection to the hull and machinery is afforded by a steel belt of 14 inches maximum thickness, covering over seventy per cent of the load line. This belt extends from 4 feet 6 inches below the load line to 3 feet above it. Above this belt to the main deck bevel between the 12-inch gun turrets, a belt of 4-inch armor is worked to cause shell loaded with high explosives to break up before entering the vessel. On top of the 14-inch armor a horizontal deck 2¾ inches thick is worked, and from the ends of the side armor to the extremities of the vessel a similar deck 3 inches in thickness is provided. Above the armor decks, belts of cellulose to prevent the inrush of water in the event of the vessel being injured are provided. The hull is built on the cellular system, with inner bottom, and great attention has been given to the subdivision of the vessel into a large number of watertight compartments, each provided with its own means of pumping and draining.

The machinery and boilers are arranged in six watertight compartments. The engines are of the inverted, direct-acting, triple-expansion type, driving twin screws. The smoke pipes are in height 100 feet above the grate bars, and the performance of the boilers under natural draught is expected to be a great improvement over boilers in existing naval vessels.

The ventilation and incandescent lighting plants of the vessel have been especially studied, in order to insure comfort and health to all on board.

Electric search lights of great power are provided, capable of lighting up a zone about the vessel through which no torpedo vessel can pass unnoticed, and the machine guns are so disposed as to bear upon all portions of this zone, and should a craft by any means get through this area of light and gun fire, stout torpedo nets reaching from water line to keel are ready to receive the torpedoes discharged.



LANTERN SLIDE COLORING.

HOW TO COLOR LANTERN SLIDES.

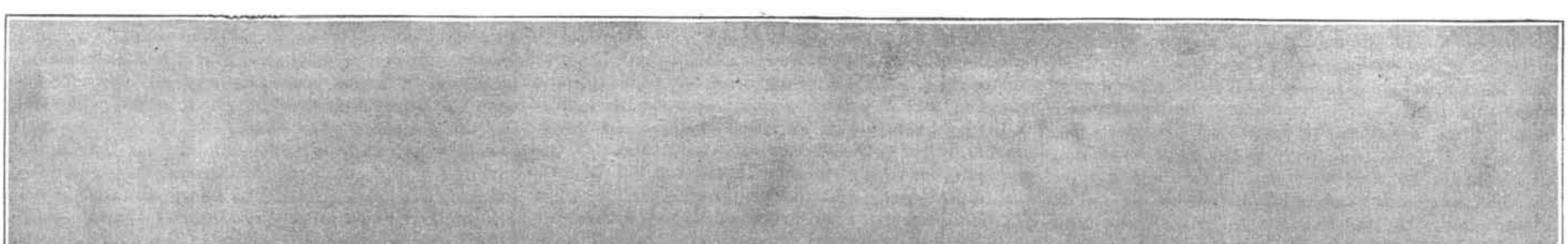
BY GEO. M. HOPKINS.

Nothing is more interesting and satisfactory to the amateur photographer than to place upon the screen, by means of a good lantern, the results of the summer's work; and, while it may be questioned whether anything can be more desirable for projection than a really first-class, well-toned lantern slide, yet experience proves that the majority of people who enjoy an evening with the lantern are pleased when a well-colored slide is shown.

A suitable subject carefully printed and artistically colored, when reflected from the screen, strongly resembles a huge water color picture, the great difference between such a picture and a water color being a superabundance of detail, which is inherent in photographic pictures and which is not desirable in a water color. A photo. can be made which will answer admirably for coloring which would not be satisfactory as an uncolored picture. Such pictures are taken through a large diaphragm or with full opening. The foreground is made sharp, while the middle distance and distance are softened down by being a little out of focus; however, it is not advisable to try to make negatives expressly for colored pictures.

The print for coloring should be moderately light and without great contrasts. Inky shadows are to be avoided, and it is well to vignette off the distance to give atmosphere. The sky should be transparent, unless cloud effects are to be shown. While specks, pin holes, and lint are very damaging to an otherwise fine lantern slide, they entirely spoil a picture for coloring. In a picture well broken up, as in a woods scene, where little sky appears and when there is no placid water, these small defects do little harm; but in a sky or in a clear lake or pond, they can never be concealed or removed so as to be unnoticed, so that the first requisite for a good colored lantern slide is a good print of the proper intensity, and with transparent lights. The second requisite is a knowledge of colors and coloring, and the third and last thing needed is an assortment of colors and brushes.

With regard to the slide itself, it might be mentioned in passing that anything which tends to harden the film in developing, fixing, or after treatment interferes with the free working of the colors. For instance, alum in the fixing bath, intensifying and re-



THE UNITED STATES BATTLESHIP IOWA—9,000 TONS, 11,000 H. P.

ducing solutions all tend to harden the film and prevent the free absorption of color.

The first operation in lantern slide coloring is to soak the plate in cold water until the film will absorb no more; then while it is still wet, go over the entire surface of the film with a thin wash of warm color, which may be either yellow or pink, depending upon the subject. This kills the chalky whiteness of the high lights, and gives the entire picture a warm and desirable tone, even though the wash is not sufficiently strong to be detected when the picture is thrown upon the screen.

The colors used for this purpose are transparent aniline colors prepared for coloring photographs. They are labeled brown, blue, violet, flesh, orange, green, and so on. The ordinary aniline dyes may be used instead of the prepared colors, as they are practically the same. The manipulation of the colors is the same as in water color painting. The film is kept wet continually from the beginning to the end of the operation, but after the broad washes of the first warm tint and the final sky color, the water lying on the surface of the film is allowed to dry off, leaving the film still swelled and wet, but without the surface water.

The prepared colors can rarely be applied to the slide without being reduced with water. Sometimes the best effects are produced by mixing different colors before applying them, while in other cases the effects are secured by separate washes of different colors, superposed. Each wash of color sinks into the film and is not removed by a subsequent wash.

Although an easel or support something like a retouching frame may be useful, the writer prefers to hold the slide in the hand, as shown in the engraving. The wet plate is held in a slightly inclined position in front of a lamp provided with a plain opal or ground glass shade. The writer prefers artificial light for coloring, as the pictures are to be shown generally by artificial light which is yellow. If the pictures are designed for projection by sunlight, it is undoubtedly better to color them in daylight.

The first wash is preferably put on while the slide is held in an inverted position, and while it is still flowing the blue is added for the sky, at first very light near the horizon, increasing in intensity toward the top of the slide. After this wash is set and superfluous water has evaporated, the water accumulating along the lower edge of the plate is removed with the fingers, and the slide is turned right side up, when the extreme distance, whether it be mountain or foliage, is covered with a light wash of blue, and this wash is brought well down toward the foreground. If the blue appears cold, it can be toned down by a very light wash of yellow or red. Trees in the middle distance can now be gone over with a light wash of orange or orange with a little of the flesh color or pink added. When near the foreground a very light wash of green is applied to the foliage, but the raw green of the color set cannot be used for this; it must be modified by the addition of orange or of brown. If when applied the green appears too cold, it may be toned down by a light wash of brown, of orange or flesh color. It is desirable to produce variety in the foliage.

Rocks in the distance are washed with blue and the color is subsequently modified by washes of red or brown. Trunks of distant trees and some rocks may be left nearly the original color of the photo., but near rocks and tree trunks may be tinted with brown, blue, or warm green, and subsequently modified by washes of green, red, brown, yellow, or orange.

It is useless to trace the smaller branches of trees and shrubs; and it is rarely necessary to deal with single leaves or blossoms; when this must be done a jeweler's eye glass is required, and fine, small brushes are used, great care being taken to keep within the outline of the object being colored. In all this work, the artist does well to remember that the coloring is to stand the test of great magnification and strong light.

The plate is apt to dry out in some places while the coloring is going on at other places. As coloring cannot be successfully done on a dry surface, it is important to wet the surface before proceeding. This is done by applying water with a soft camel's hair brush. After the surface water has disappeared the coloring may proceed.

It is obviously impossible to mention every modification of color that may be produced by mixtures and washes. This is something to be acquired by practice. The writer uses very few colors, rarely more than the following: Blue, green, brown, orange, flesh, rose, and yellow. The last is a strong color which must be applied with caution. Green and blue are also strong colors which can never be applied without the admixture of a warm color, or a subsequent wash of the same. Brown in different strengths has a large application. It is useful in toning down bright greens, for rocks, tree trunks, earth, etc. A wash of blue over the brown produces a different but useful gray.

The principal points to be observed are to keep the plate always wet, to use light washes, to modify color by subsequent washes, and in working up details to preserve the outlines.

Should a small area be over-colored, the color may generally be partly removed by means of a soft brush charged with clean water, the brush being gently and repeatedly passed over the spot. The brush is frequently washed during the operation. When the broad washes show streaks, or when the entire slide is too highly colored, or the effects are unsatisfactory, the only remedy is to place the slide in cold water and allow it to soak, with occasional changes of water, until the color is partly or entirely removed.

It is well enough to bear in mind that a colored lantern slide bears all the color that is to appear on the screen; consequently, it must be more highly colored than a transparency for direct vision. On the screen, however, a picture is better under-colored than over-colored. It will often be found that prints which are too light and flat for use as plain slides answer very well when colored, and pictures which are too dark for use as plain slides may be tinted with blue and presented as moonlight scenes.

Brushes for this work should be of the best quality, very soft and pliable, and such as are used for working up detail must have a fine point.

This method applies to portraits and figure pieces.

The colored slides are generally mounted in the same manner as the plain ones. If, however, the highest perfection is sought, thin plate glass is used for the sensitive plates, and glass of the same kind is used for covers, the cover and colored picture being cemented together with Canada balsam. Made in this way, the slides are more transparent; but, in view of the extra trouble and expense, the improvement over the uncemented slides is hardly sufficient to warrant the general application of this method.

Boron.*

BY H. MOISSAN.

A summary of the properties of pure amorphous boron. Boric acid is twice treated with less than the theoretical quantity of magnesium powder, and the product, on treatment with an acid, leaves amorphous boron.

Amorphous boron is a bright, maroon-colored powder, which stains the fingers and can be compressed into a cake. Its specific gravity is 2·45. It does not fuse at the temperature of the electric arc, but shrinks slightly and increases in density when heated to 1,500° in an atmosphere of hydrogen. Its electrical conductivity is very low, the specific resistance being 801 megohms.

Boron takes fire in the air at 700°, and burns in oxygen with a brilliant green flame, having little actinic power; in either case the combustion is soon stopped by the formation of a layer of boric anhydride on the surface of the boron. It combines energetically with sulphur at 610° to form a sulphide, which is decomposed by water with evolution of hydrogen sulphide. It behaves in the same way with selenium, but does not combine with tellurium.

Boron burns in dry chlorine at 410°, and in bromine vapor at 700°, with the formation of boron chloride and bromide. It is dissolved by bromine water, and more readily by a solution of bromine in potassium bromide solution, but it does not combine with iodine.

It combines with nitrogen at 1,230°, but not directly with phosphorus, arsenic, or antimony. Neither does it combine directly with carbon or silicon, although a boron carbide is formed when boron is heated in the electric arc in an atmosphere of hydrogen.

The alkali metals have no action on boron, but magnesium combines with it at a red heat. Iron and aluminum form borides only at high temperatures, while silver and platinum combine with it quite readily.

Acids react energetically with boron; sulphuric acid is reduced at 250°; the action of nitric acid is so vigorous as to raise the temperature to incandescence; phosphoric anhydride is reduced to phosphorus at 800°; arsenious and arsenic acids are reduced to arsenic at a dull red heat; iodic acid in solution is reduced to iodine in the cold, and a mixture of the dry acid with boron becomes incandescent, and iodine is evolved; chloric acid is reduced to chlorous acid.

The hydracids react with greater difficulty. Hydrogen fluoride is not attacked until a dull red heat is reached, when boron fluoride is formed and hydrogen liberated. Hydrogen chloride is attacked only at a bright red heat, while its aqueous solution has no action whatever on boron.

Sulphurous anhydride is reduced to sulphur at an incipient red heat. Steam is not attacked until a full red heat is attained; but the action, once started, proceeds with great energy, boric acid being formed and hydrogen set free. Carbonic oxide is reduced to carbon at 1,200°. Silica is reduced to silicon when heated in a forge. Nitrous oxide is decomposed by boron at a dull red heat, boron nitride and boric acid being formed; nitric oxide is not affected by it.

Metallic oxides are more readily reduced by boron than by carbon. When, for instance, a mixture of boron and cupric oxide is heated in a glass tube, the reaction which ensues is so violent as to melt the glass. Stannous oxide, litharge, antimonious and bismuth oxides are all readily reduced. A mixture of boron and lead peroxide detonates violently when triturated in a mortar. Ferric and cobaltous oxides are reduced at a red heat, but the oxides of the alkaline earths are not affected. Hydrogen is liberated by boron from fused potassium hydroxide. A mixture of boron, sulphur, and niter deflagrates at a dull red heat, while small quantities of boron projected into fused potassium chlorate burn with a most dazzling flame.

Boron acts very energetically on the metallic fluorides; it decomposes the fluorides of the alkalies and alkaline earths at a bright red heat; zinc fluoride at a dull red heat, boron fluoride being formed; and it acts with even explosive violence on lead and silver fluorides. Its action on the metallic chlorides is not so energetic. The chlorides of the alkalies, the alkaline earths, zinc, and lead are not attacked at a red heat, but mercurous chloride is reduced to mercury at 700°. Lead, zinc, cadmium, and copper iodides are not reduced by boron, but tin and bismuth iodides are reduced with facility. Potassium, sodium, calcium, and barium sulphates are reduced by boron at a red heat to the corresponding sulphides.

Nothwithstanding its great affinity for oxygen, boron may be immersed in fused potassium nitrate without any reaction occurring, provided the temperature is below that at which oxygen is disengaged. Fused potassium nitrite, however, is decomposed by it with great violence. Sodium carbonate is reduced at a dull red heat, potassium carbonate at a somewhat higher temperature, and calcium and barium carbonates not at all.

The arsenites, arsenates, and chromates are all reduced at a dull red heat.

Boron behaves also as a reducing agent in the wet way. It reduces potassium permanganate solution, partially in the cold, entirely on heating. It reduces ferric chloride to ferrous chloride. It precipitates silver from silver nitrate solution in fine crystals, and reduces palladium, platinum, and gold from solutions of the chlorides of these metals.

Boron thus combines with the non-metals much more readily than with the metals. It is a more powerful reducing agent than either silicon or carbon, and, on the whole, is most nearly allied to the latter element. —*Am. Jour. Pharm.*

* *Compt. Rend.*, 114. 617–622; *Jour. Chem. Soc.*, October, 1892, p. 1153.

The Dakota Meteoric Stone.

BY A. E. FOOTE.

On the 29th day of August, 1892, about 4 o'clock in the afternoon, while Mr. Lawrence Freeman and his son were stacking upon his farm two miles south of Bath, they were alarmed by a series of heavy explosions. On looking up they saw a meteoric stone flying through the air, followed by a cloud of smoke. Its course was easily traced to the point where it fell, within about twenty rods from where they were standing. The stone penetrated the hardened prairie to a depth of about sixteen inches, and when reached it was found to be so warm that gloves had to be used in handling it. Three small pieces of an ounce or two each had apparently been blown off by the explosions, but the stone still weighed 46¾ lb. One of these small pieces was found by some men not far distant, and was broken up and distributed among them. The explosions were plainly heard by a large number of people at Bath, two miles away, and at Aberdeen, nine miles away, it sounded like distant cannonading. The exterior of the stone presents the usual smooth black crust. The interior is quite close grained, resembling in texture the stones from Mocs. The iron is abundantly disseminated through the mass; and although the grains are small, they are easily distinguished, and separated on pulverizing.

Preliminary tests made by Mr. Amos P. Brown, of the Mineralogical Department of the University of Pennsylvania, prove the presence of nickel and cobalt in considerable quantity.—*Amer. Jour., January*, 1893.

Wood Pulp.

Compared with its predecessor, last year shows a slight decline in the production of wood pulp, the figures being 210,000 tons for 1892, against 230,000 tons for 1891. The value of last year's production is estimated at about £420,000. No manufactories for mechanical wood pulp have been erected in Norway during 1892, and the number of such factories still remains at fifty-eight, of which about a dozen are connected with paper mills. The Wood Pulp Union has arranged that operations shall be suspended for a month during the year, and that last year's quotations of 36 kr. for wet and 75 kr. to 80 kr. for dry wood pulp per ton f. o. b. shall be maintained. A considerable quantity of this year's production has already been sold. The market for chemical wood pulp improved during 1892, and prices were a little higher at its close than at the commencement. There are now in Norway eleven sulphite and four sulphate manufactories. Several of these are also connected with paper mills. The exports during 1892 of chemical wood pulp were about 20,000 tons dry, as compared with 17,500 tons in 1891, and about 8,500 tons wet, as compared with 9,500 tons in 1891.