PHOTOGRAPHY IN THE COLORS OF NATURE.

Photography in natural colors has again been going the round of the newspapers, this time from the West, but, like the cry of "wolf," it has so often been a false alarm, that it has received but scant attention; although, this time, there really is something, and something very important, in it.

Prof. R. W. Wood, of Wisconsin University, is the inventor of the method, which, briefly stated, is the production of a positive on which there is neither pigment, colored lines, nor color in any form; and yet when examined through an ordinary double convex lens it is seen in all the colors of the original, and, if possible, in colors more brilliant than those of nature's own. Nor is that all. Even more surprising is the fact that from that positive there may be printed by simple contact, and as simply as are printed lantern slides, as many copies as may be desired, every-one of which will show the colors in the same way and with the same brilliance.

Diffraction photography, according to Prof. Wood, in the Philosophical Magazine for April, is founded on the fact that if a diffraction grating of moderate dispersion and a lens be placed in a beam of light from a linear surface, and the eye placed in anyone of the spectra formed to the right and left of the image, the entire surface of the grating will appear illuminated with colored light, the color depending on the part of the spectrum in which the eye is placed. If one part of the grating has a different spacing from the rest, the spectrum formed by this part will be displaced relatively to the first, and if the eye be placed on the overlapping parts of the two spectra, the corresponding parts of the grating will appear illuminated in different colors.

If, then, three gratings are taken, of such spacing that the deviation of the red of the first is the same as that of the green of the second and blue of the third, and mounted side by side in front of a lens, their spectra will overlap, and an eye placed in the proper position will see the first grating red, the second green, and the third blue. If the first and second overlap, yellow will appear, and if all three, white light will be the result.

On this foundation, which perhaps only the initiated can fully understand, Prof. Wood has planned his method, not yet perfect, of course, but one that, in our opinion, will before long lead to the sale in every fancy store in this and other lands of pictures that, when seen in the little instrument that will go along with them, shall appear in all the colors of nature; and that both instrument and say a dozen of pictures will cost less than a dollar.

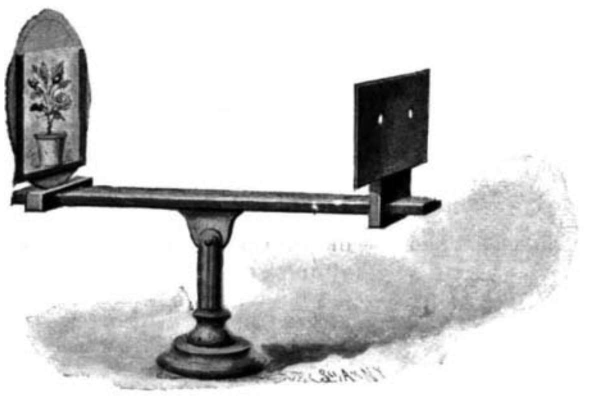
The first step in the production of a diffraction photograph is to make three negatives through red, green, and blue glass in the ordinary way, and from them to print positives on albumen transparency plates, albumen rather than gelatine, as the latter would soften in the warm water of the next operation. Prof. Wood employs albumen lantern slide plates. Those positives, when dry, are coated with bichromated gelatine and printed, each under a suitably spaced grating, and washed in warm water till the bichromate and unacted-on gelatine are washed away. Such positives, when examined by reflected light, and with the eye in the suitable position, show, respectively, the red, green, or blue of the object photographed and only need to be superimposed to show it in all its colors and shades combined.

And it is here that the most surprising part of the process comes in, so surprising, indeed, that the professor says, "It is almost incredible." A bichromated gelatine plate is printed successively under all three positives, washed in warm water as before, and dried; and although the gratings may contain some 2,000 lines to the inch, and to the lay mind must seem simply a confused mass, each does its own peculiar work, sends its own color to the eye and mixes them as they go, so that a bouquet of nature's own most brilliant painting appears in all its glory.

Not less wonderful is the fact that in this stereotype plate as we may call it we have the means of making it multiply itself by the thousand; all that is necessary being to employ it as an ordinary negative, from which as many copies may be printed as we desire and on bichromated gelatine plates.

It has been said that the eye must be in "a suitable position." To find that at a glance, Prof. Wood has devised a simple instrument that will answer the purpose admirably. It is essentially a cheap bi-convex lens, mounted in a frame to secure its correct position in relation to the picture, and need not cost as much as the cheapest of cheap stereoscopes. The cut will explain itself.

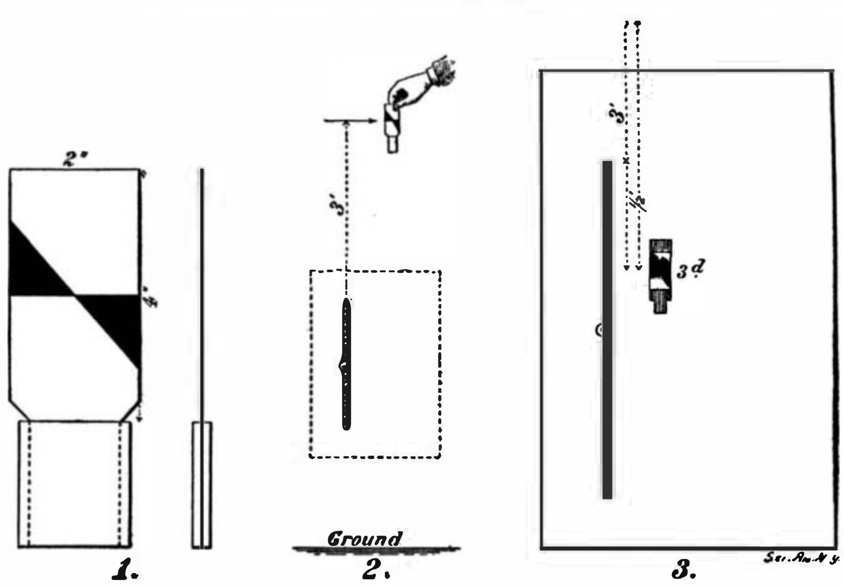
One serious obstacle to the prosecution of this kind of work is the great cost of gratings large enough for the purpose; but that the professor gets over in a simple and apparently an efficient way, as will be seen from his description of his method of enlarging up to any reasonable extent. He says: "The original grating ruled on glass was mounted against a rectangular aperture in a vertical screen, the lines of the grating being horizontal. Immediately below this was placed a long piece of heavy plate glass, supported on a slab of slate to avoid possible flexure. A strip of glass, a little wider than the grating, sensitized with bichromated gelatine, was placed in contact with the lines of the grating, and held in position by a brass spring. The lower edge of the strip rested upon the glass plate, so that it could be advanced parallel to the lines of the grating, and successive impressions taken by means of light coming through the rectangular aperture. In this way I secure a long narrow grating, and by mounting this against a vertical rectangular aperture, and advancing a second sensitized plate across it in precisely the same manner, I obtained a square grating of twenty-five times the area of the original. It was in this manner that I prepared the grating used to print the impressions on the three positives. So well did they perform, that it seemed as if it might be possible in this way to build up satisfactory gratings of large size for spectroscopic work. Starting with a one inch grating of 2,000 lines, I have built up a grating eight inches square, which, when placed over the object-glass of a telescope, showed the dark band in the spectrum of Sirius with great distinctness. No especial precautions, other than the use of the flat glass plate, were taken to insure absolute parallelism of the lines, and I have not had time to thoroughly test the grating. The spectra, however, are of extraordinary brilliancy, and, on the whole, the field seems promising."



DIFFRACTION-SCOPE.

THE MEASUREMENT OF SHUTTER SPEED.

There are to-day published a number of tables giving the proper time of exposure for different subjects in different classes of light, at all hours of daylight, and all seasons of the year. These tables are a valuable guide to photographers; but in order to use them intelligently, it is necessary to know the speed of one's shutter. The figures found on the indicator dials of most shutters are far from accurate, but are generally accepted as correct because at first sight the measurement of a shutter's speed, when set for instantaneous work, appears too difficult to be attempted. It may, however, be accomplished quite accurately in the following simple manner. Take a piece of white cardboard shaped as shown in Fig. 1, and draw upon it the figure shown, being careful that the upper edge of the lower black triangle is in prolongation of the lower edge of the upper triangle. Now insert the narrow part of the card in a piece of lead pipe about 2 inches long and 1 inch in diameter, and then flatten the pipe so as to fasten it securely to the card. With the addition of an ordinary 2-foot rule, this is all the apparatus needed.



1. 2. 3.

THE MEASUREMENT OF SHUTTER SPEED.

Select a brightly lighted wall, and mark a point about 6 feet above the floor or ground. Then fasten the rule vertically against the wall with its upper end exactly 3 feet below the mark. Set up the camera squarely in front of the rule and at such a distance as will give the largest possible image of the entire length of the rule. Focus sharply and use a small stop.

The card should now be held so that its center mark is just beside the 6-foot mark on the wall. Fig. 2 shows all in readiness for the drop, the dotted rectangle representing the field of view of the camera.

Now release the weighted card so that it will fall close beside the rule, and expose the plate while the card is passing the rule. This will require care, and it would be well to practice it several times without withdrawing the plate-holder slide.

The plate must now be developed, and will show a picture like Fig. 3, in which the center mark of the card is blurred by its motion. This motion must be measured by the scale shown in the photograph of the rule (never with the rule itself), and must be expressed in feet. Call this distance d.

Let t be the time in seconds that the shutter was open. Then $\frac{d}{t} = v$, the velocity of the card in feet per second at the time of exposure. Observe the distance that the center of the blurred mark has fallen below the upper end of the rule. Add 3 feet, and the sum is the total distance that the card has fallen. Call this h.

Neglecting air resistance, we have from the law of falling bodies $v = \sqrt{2gh}$. Equating the two values of v, we have $\frac{d}{t} = \sqrt{2gh}$. Solving for t, we find $t = \frac{d}{\sqrt{2gh}}$, in the second member of which all the quantities are known.

Example.—$d = 3'' = 0{\cdot}25'$; $h = 4'$; g may be assumed as 32·2. Then $t = \frac{d}{\sqrt{2gh}} = \frac{0{\cdot}25}{\sqrt{257{\cdot}6}} = 0\ 0156$ second, approximately.

The card may be dropped from a greater height than 3 feet above the rule, and the greater the fall of the card, the greater will be the accuracy of the result; but the greater will be the difficulty of getting the picture of the card at the proper place.

The following table gives shutter speeds from $\frac{1}{500}$ of a second to about $\frac{1}{80}$ of a second with sufficient accuracy for ordinary purposes. By placing the camera at a greater distance from the wall and using a longer drop of the card, the table may be extended as desired.

Total Fall in Inches.	Fall of Card During Exposure, in Inches.											
	0·5	1·0	1·5	2·0	2·5	3·0	3·5	4·0	4·5	5·0	5·5	6·0
36	0·003	0·006	0·009	0·012	0·015	0·018	0·021	0·024	0·027	0 030	0·033	0·036
42	0 003	0·006	0·008	0·011	0·014	0·017	0·020	0·022	0·025	0·028	0·031	0·034
48	0·003	0 005	0·007	0·010	0·013	0·016	0·018	0·021	[illegible] 023	0·026	0·028	0·031
54	0·003	0·005	0·007	0 010	0·013	0·015	0·018	0 020	0·022	0·025	0·027	0·030
60	0·002	0·004	0·007	0·009	0·012	0·014	0·017	0·019	0·021	0·023	0·026	0·028

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An Automobile Journey from Cleveland to New York.

On Monday, May 22, a Winton motor carriage started from Cleveland for New York. The distance from Cleveland to Buffalo, 218 miles, was covered in 11 hours. On May 23 the carriage ran from Buffalo to Fairport, 94 miles, in 7 hours. On May 24 it ran from Fairport to Syracuse, 80 miles, in 7 hours and 48 minutes. On May 25 the carriage ran from Syracuse to Albany, a distance of 154 miles, in 11 hours and 52 minutes. The total distance traveled was 546 miles; the total time 37 hours and 40 minutes to Buffalo. The difference between the roads from Cleveland to Buffalo and Buffalo to Albany is clearly shown by the difference in running time. The carriage in use weighs 1,700 pounds and is driven by a six horse power motor.

Americans Elected to the Royal Institution.

The Royal Institution of Great Britain, in commemoration of its centenary, has elected a number of American honorary members. The list includes Dr. Samuel Pierpont Langley, Secretary of the Smithsonian Institution, Prof. A. A. Michelson, of Chicago, Prof. R. H. Thurston, of Cornell University, Prof. George F. Barker, of the University of Pennsylvania, and Prof. W. L. Wilson, President of Washington and Lee University, and former Postmaster-General.

AN atlas, in sixty-five sheets, of the upper Yangtse-Kiang River, drawn from the surveys of Father Chevalier, of the Jesuit observatory at Si Ka-wei, is about to be published at Shanghai.