

known, the standard instruments being those which depend upon the colors of the spectrum itself, defining the color of an object in terms of its dominant hue, corresponding to a given position in the spectrum. Any color may then be defined in terms of the spectral position of its dominant hue and of the amount of white light which must be mixed with the spectral color to match the color in question.

This form of colorimeter is suitable primarily for use in the laboratory, but for use in the works more rugged and simple instruments have been designed, the latest being a subtractive instrument designed in the research laboratory of the Eastman Kodak Company which is based on the use of colored wedges, each wedge absorbing one-third of the color of the spectrum, so that the three wedges are yellow, blue-green, and magenta in color, the yellow wedge absorbing the blue light, the magenta, the green light, and the blue the red light. When these wedges are placed over each other in pairs, they will match any color provided that the intensity is adjusted at the same time by the use of a neutral gray wedge which is supplied as the fourth wedge of the instrument. The instrument is made with a number of attachments according to the purpose for which it is required, so that colored solutions, colored glasses, or colored pigments can all be measured by suitable attachments. A modified form of the instrument has been designed for use in measuring vegetable oils and especially for use with cottonseed oil.

EXPERIMENTS ON SULFIDE TONING.*

By E. R. Bullock and (in part) D. S. Mungillo.

(I) *The Effect of Modification of Ordinary Indirect Sulfide Toning.*—In the well-known method of sepia toning which consists in bleaching a black-and-white print in a bath of ferricyanide and bromide solution and redarkening it in a bath of sodium sulfide solution, a great many variations were made in the concentration, time of action, etc., of baths and also in the composition of the baths as far as this seemed possible without altering the chemical composition of the final (toned) image. The purpose of the experiments being to observe the variation with conditions of the color change which occurs on converting a silver image sub-

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stantially into one of silver sulfide, all such variations as the addition of a mercury salt to the bleach bath or of Schlippe's salt to the darkening bath were omitted.

Prints on Special Velvet Velox and Artura Carbon Black were prepared under conditions standardized for each paper and giving a supply of somewhat fully developed prints of good gradation in each case. The standard procedure adopted as normal for the toning process was substantially that given in recent issues of the *British Journal Photographic Almanac*.

A number of variations in the toning procedure which were found to have no influence on the final tone are enumerated in a separate table. A tone somewhat more purple than normal—hence usually an improvement—is obtained by the use of a bleach (such as permanganate-chloride) which converts silver to silver chloride, or by a brief immersion of the bleached print in a one per cent. sodium carbonate solution immediately prior to sulfiding, or (to a greater extent) by both. A tone which deviates—under certain conditions very greatly—from the normal in the opposite direction of yellow is obtained by the use of a plain ferricyanide, a ferricyanide-chloride, or a ferricyanide-iodide bleach, by immersing in an iodide solution prior to darkening, by adding iodide to the sulfide bath, by using a (ye'low) polysulfide in place of ordinary (colorless) sodium sulfide, by using very dilute sodium sulfide solution as the darkening bath, or by having considerable hypo present in a somewhat (or very) dilute sulfide bath.

(II) *The Polysulfide Method of Direct Sulfide Toning*.—This method gives tones which are identical with those obtained with hypoalum, and which are considerably more purple therefore than those given by the standard method above. The preparation of a suitable polysulfide toning bath was described; and it was found that it is possible to accelerate the somewhat slow action of this bath, without affecting the tone obtained, by the addition to it of either potassium sulfocyanide or thiocarbamide.

The Effective Temperature of Certain Stars. NORDMANN AND LEMORVAN. (*Comptes Rendus*, July 11, 1921.)—The determination of the temperature is based on results obtained with the heterochrome photometer interpreted by a study of the distribution of intensity in the spectra of the stars. The absolute temperatures of 17 stars are given, ranging from 27,700° to a mere 3050°. The North Star is credited with 8200°. G. F. S.