METHOD AND APPARATUS FOR DETECTING FLUORESCENT PARTICLES CONTAINED IN A SUBSTRATE

FIELD OF THE INVENTION

[0001] These teachings relate to apparatus and methods for authentication of documents and similar substrates.

BACKGROUND OF THE INVENTION

[0002] It is well known that valuable items such as negotiable instruments and art work are susceptible to theft and counterfeiting. The advancement of color copier technology has made it fairly easy to create a color copy of any document, including currency, using commonly available equipment. In an effort to stem widespread counterfeiting of currency many countries, including the United States, now include a watermark, a security fiber, or both, in their paper based currency. These security features give the receiver a means to verify a particular note's authenticity. The security fiber is embedded in the paper on which the money is printed, and may include a human readable (albeit small) description of the currency imprinted on its surface. Other features may be embedded for authentication purposes. For example, aside from fibers, it is known to utilize planchets and particles to authenticate items. These types of authentication mechanisms may be color based. That is, the security features may exhibit a characteristic color, they may diffract light, or they may fluoresce when subjected to an excitation. For example, these mechanisms may fluoresce under infrared (IR), visible (VIS), or ultraviolet (UV) radiation.

[0003] One problem with the use of sophisticated techniques for the protection of valuable items having such security features is the ability to rapidly, reliably and/or remotely authenticate the items. Consider one aspect involving color detection techniques and apparatus.

[0004] Techniques and apparatus for color assessment encompass many schemes and instruments. Typically, the standardization of color data between devices calls for use of a color classification algorithm to achieve equivalence between devices. A number of algorithms are known and used. For example, two commonly used color space models are the CIE L,a,b color standard produced by the international standards organization "Commission International de l'Eclairage or International Commission on Illumination," and the HUNTER LAB™ L*a*b model, produced by Hunter Labs of Reston Va.

[0005] In regard to an instrument, many factors enter into performing accurate measurements of color. Included are instrument design, detector limitations, color algorithms, lighting characteristics, and surface characteristics among others. Generally speaking, there are two main types of instruments that are used for measuring the color of surfaces. These are calorimeters and reflectance spectrophotometers. Colorimeters are typically simpler instruments than spectrophotometers.

[0006] Colorimeters measure tri-stimulus values, which serve as inputs to various color models, more directly than spectrophotometers. Generally, a calorimeter operates using three broadband filters that are associated with the three primary colors. Typically, a colorimeter measures the light reflected from a target through each of the three filters. Consequently, typical calorimeters only measure reflectance at the three wavelengths associated with the three filters. Although colorimeters do not provide reflectance data for many band of wavelengths, they are sometimes considered preferable to spectrophotometers because of their low cost of manufacture and portability. One example of a colorimeter is contained in U.S. Pat. No. 6,157,454 entitled "Miniature Colorimeter."

[0007] The calorimeter disclosed in U.S. Pat. No. 6,157,454 generates, from a single color measurement, three color data points representing the reflectance of a spot measured at the wavelengths of the three primary colors. The system makes measurements against, or in close proximity to, the surface of the object to be measured. This system, typical of colorimeters, does not provide users with an ability to make assessments of multiple colors in one measurement.

[0008] The spectrophotometer is used to produce more accurate assessments of color than those that are produced by a calorimeter. In general, a spectrophotometer uses a specific light source to illuminate the specimen being measured. The light reflected by the object passes to a grating that breaks it into the spectrum. The spectrum falls onto a diode array that measures the amount of light at each wavelength, or range of wavelengths. The spectral data is then sent to a processor where it is combined with data table values for the selected color scale (herein algorithm or model) to produce the coefficients that describe the perceived color. The spectrophotometer is calibrated using a target whose reflectance at each wavelength is known, as compared to a perfect, diffuse reflecting surface. Once calibrated, a user proceeds with color measurement. Certain factors, such as the instrument and sample geometry, as well as surface finish, can play significant roles in the refinement of color measurements when using a spectrophotometer.

[0009] One example of a portable spectrophotometer is described by U.S. Pat. No. 6,346,984 entitled "Portable Scanning Spectrophotometer." This patent discloses providing movement and control of a sample during analysis. The unit includes a base and an upper assembly supported on the base for floating movement. A planar media guide is located on the underside of the upper assembly and surrounds the spectral engine to engage the sample and reduce flexing and bowing of the sample.

[0010] Some problems with some existing authentication systems include the incorporation of specialized apparatus, such as sequentially energized light sources to create multiple images. Reference may be had to U.S. Pat. No. 6,269,169 "Secure Document Reader and Method Therefor," issued Jul. 31, 2001 to Funk et al. Funk et al. disclose apparatus and a method for reading documents, such as identity documents, including passports, and documents of value, to obtain and verify information recorded thereon, and to read and/or detect security information thereon to determine if such documents are counterfeit or have been altered.

[0011] Reference may also be had to U.S. Pat. No. 5,418,855 "Authentication System and Method," issued May 23, 1995 to Liang et al. This patent discloses a system for authentication of articles, wherein articles which have been marked with substances that fluoresce are tested. U.S. Pat. No. 5,608,225 "Fluorescent Detecting Apparatus and