ILLUMINATION SYSTEM FOR MATERIAL TESTING APPARATUS

The present invention relates to apparatus to test resistance against the influences of light and weathering on samples of goods, such as paint, fabrics, or other material, and more particularly to provide an apparatus which can accurately reproduce spectral conditions under controlled circumstances, for example simulating sunlight with controlled ultraviolet (UV) and infrared (IR) components, that is, sunlight which might occur under various atmospheric conditions and geographic locations, e.g., at sea level, high altitudes, or the like.

BACKGROUND

The Assignee of the present application is the manufacturer of a rapid illumination and weather testing apparatus trademarked "Xenotest 1,200" ®, and described, for example, in literature material D310 561/681. The apparatus permits checking of various and highly different materials with respect to resistance to fading due to light and weather, or other environmental effects. For example, paints, lacquers and varnishes can be tested with respect to color fidelity and maintenance, and also with respect to their mechanical and overall technological behavior. The apparatus has an illumination device with three radiation sectors, which include selectively reflective mirrors, reflecting UV radiation, and being transparent to IR radiation. The selective mirrors extend radially from a common axis outwardly, separating the respective sectors. A IR absorber is located between two each of selectively reflective mirrors of adjacent sectors.

Each one of the three sectors has a xenon radiation source associated therewith to provide the required radiation. This filter-radiation arrangement is surrounded by a quartz inner cylinder with a selectively reflective layer for IR radiation, but passing UV and visible spectral components. A water jacket follows the inner cylinder. The water jacket absorbs long wavelength IR radiation. A quartz outer cylinder, and, eventually, a jacket made of UV special, or window glass, surrounds the structure.

The filter system provides radiation with an energy distribution which very closely matches that of the radiation derived from sunlight. The filtering system largely filters undesired IR components by absorption, and permits passage, selectively, in the short-wave region of a high proportion of radiation to reach the test samples located about the illumination source.

U.S Pat. No. 3,686,940, Kockott, the disclosure of which is incorporated by reference herein and which patent is assigned to an associated organization of the Assignee of the present application, describes a testing apparatus with selective mirrors for removing infrared radiation. The structure has a plurality of eccentrically located radiation sources. A cylindrical mirror is provided which selectively reflects the IR component of the radiation, but is transparent for visible and UV spectral components. Mirrors which are selectively reflective for visible and UV components of the radiation, but passing IR components, are located between the radiation source and the cylindrical mirror. This arrangement permits elimination of short-wave IR radiation, which cause heat, without essentially attenuating the UV radiation.

It has been found that some IR filters, and particularly KG filters, that is, heat absorption filters, when also subjected to UV radiation, change their filtering characteristics. Such filters are particularly desirable and useful to test for resistance to fading, and light effects. These filters have the tendency to change their filtering limit in the UV region towards longer wavelength to such an extent that the desired radiation spectrum is undesirably influenced thereby. The change of the UV limitation is also referred to as aging of the filter.

OBJECT OF THE INVENTION

It is an object to provide a light and weathering resistance test apparatus, particularly to test articles with respect to their resistance to UV and visible spectral light, approaching sunlight, which permits precise adjustment of the respective spectral components and more particularly of IR and UV spectral components and the proportion of visible light within the radiation spectrum. The adjustment should be stable, not subject to change due to aging or the radiation from the source itself. The arrangement should provide a test spectrum for the samples to be tested which matches, as closely as possible, sunlight radiation or a selected spectral distribution, with high efficiency, and with minimum losses due to absorption or reflection.

SUMMARY OF THE INVENTION

Briefly, IR filters, UV filters and UV mirrors are used. Special IR mirrors, which are usual in illumination systems of this type are not needed, however.

A central light source emits radiation in the UV, visible and IR spectral ranges. A sample is positioned, spaced from the central light source in the path of radiation therefrom. The radiation impinging on the sample is controlled by a plurality of UV mirrors, reflecting UV radiation without, essentially, passing UV radiation therethrough, that is, they have a high reflectivity efficiency. At least one UV filter is provided, passing UV radiation and at least one IR filter, passing IR radiation. The region surrounding the light source is subdivided into sectors. In accordance with the invention, a UV filter is located in a first sector and forming a first outer filter; a first mirror-filter combination formed of the first UV mirror having a mirror surface directed towards the light source and an IR filter, essentially congruent with the UV mirror, is provided, the IR filter of the first mirror-filter combination forming a second outer filter. A second mirror-filter combination, and including an essentially congruent sandwich formed by an inner UV mirror having its mirror surface directed towards the light source, an outer UV mirror having its mirror surface directed towards the outer filters, and a IR filter located between the inner and the outer UV mirrors is so located that it places the UV first outer filter entirely within its optical shadow with respect to radiation from the radiation source. The second mirror-filter combination is located spaced from the first mirror-filter combination and positioned between the light source and the first mirror, to direct UV radiation and light to the first UV filter of the first sector. The first UV filter of the first sector thereby forms a radiation window for UV radiation reflected within the spectral control structure from the source, while separating UV radiation from the IR filters, thereby preventing the IR filters from deteriorating under UV light thereon, and preventing aging of the IR filters.