TEMPERATURE-CONTROLLED ACCELERATED WEATHERING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to accelerated weathering test devices of the type used to expose test samples of exterior coatings such as paints and finishes, as well as fabrics and other materials to solar radiation and other weathering effects on an accelerated basis, and more particularly, to such an accelerated weathering test device adapted to maintain a substantially uniform test sample temperature during daylight hours, despite variations in ambient air temperature and variations in solar radiation intensity.

2. Description of the Prior Art

Manufacturers of exterior coatings such as paints and finishes, as well as plastics, and other components which tend to degrade under exposure to solar radiation and other weathering effects, often want to know how such products will perform following years of exposure. However, such manufacturers typically require such information in a much shorter time than it would take to expose such materials to weathering effects under normal conditions. Accordingly, accelerated weathering test devices have been developed which accelerate the effects of weathering due to outdoor exposure in a much shorter time so that manufacturers need not actually wait five or ten years in order to determine how their products will hold up after five or ten years of actual outdoor exposure.

One known accelerated weathering test device is disclosed in U.S. Pat. No. 2,945,417 issued to Caryl, et al. The aforementioned test device includes a Fresnel-reflecting solar concentrator having a series of ten flat mirrors which focus natural sunlight onto a series of test samples secured to a target board measuring approximately five inches wide by fifty-five inches long. The Fresnel-reflecting solar concentrator directs solar radiation onto the target board area with an intensity of approximately eight suns. Both the bed which supports the mirrors of the solar concentrator, and the target board, are supported by a frame which can be rotated to follow daily movements of the sun. A solar tracking mechanism responsive to the position of the sun, controls the operation of an electric motor that is used to rotate the test apparatus to follow movements of the sun. The axis of rotation of the test machine is oriented in a north-south direction, with the north elevation having altitude adjustment capability to account for variation in the sun's altitude at various times during the year. Such known testing devices are also provided with an air tunnel mounted above the target board. An air deflector causes air escaping from the air tunnel to be circulated across the test samples mounted to the target board to prevent the test samples from overheating due to the concentrated solar radiation to which they are exposed. A squirrel cage blower communicates with the air tunnel for blowing cooling ambient air therethrough. In addition, water spray nozzles are provided proximate to the target board for wetting the test samples at periodic intervals to simulate the weathering effects of humidity, dew, rain, etc.

Standardized testing methods have been developed for operating accelerated weathering test devices of the type described above. The American Society for Testing and Materials (ASTM) has issued Standards G90, E838, D4141, and D4364 covering the testing procedures and the operating parameters for conducting such outdoor accelerated weathering tests.

Apart from outdoor accelerated weathering test devices of the type described above, other test devices are also known which utilize an artificial source of radiation to expose the test samples. An example of such a test device is disclosed in U.S. Pat. No. 3,664,188, issued to Kockott. While such test devices have the advantage of permitting precise control over radiation intensity, temperature, and humidity, such test devices often fail to duplicate the actual light spectrum of natural sunlight to which the samples under test will actually be exposed in everyday use.

Outdoor accelerated weathering test devices of the type described above in regard to U.S. Pat. No. 2,945,417, have the advantage of using natural sunlight, and hence the samples under test are exposed to the actual spectrum of sunlight. However, one disadvantage of outdoor accelerated weathering test devices has been discovered, namely, that the temperature of the samples under test can vary widely during daylight hours over the course of a day and from one season to the next. The blower motor used to circulate cooling air across the test samples is a constant speed motor, and accordingly, the flow rate of cooling air across the test samples is substantially constant. Consequently, the temperature of the test samples constantly changes due to corresponding changes in the ambient air temperature and changes in solar radiation intensity. It has also been discovered that changes in the temperature of the test samples can alter the rate of weathering which occurs; for example, test samples tend to weather faster in the summer than in the winter due to nominally higher test sample temperatures in the summer as a result of both higher average ambient temperatures and greater solar radiation intensity.

Accordingly, it is an object of the present invention to provide an outdoor accelerated weathering test device which is adapted to maintain the temperature of the target test samples substantially constant during daylight hours despite variations in the daytime ambient air temperature, and despite variations in solar radiation intensity.

It is another object of the present invention to provide such a test device wherein the nominal target sample temperature during daylight hours may be easily adjusted by the person conducting the test.

It is yet another object of the present invention to provide a control mechanism for accomplishing the aforementioned temperature control, which control mechanism is relatively inexpensive and easily retrofitted to existing accelerated weathering test devices.

It is a further object of the present invention to provide such an accelerated weathering test device which provides a visual indication to the person conducting the test of the temperature of the test samples mounted to the target board of the test device.

With respect to accelerated outdoor weathering test devices, it is known to provide a cover or shield which can selectively be inserted between the solar concentrator and the target board to shield the test samples from solar radiation in the event of an electrical power failure. During such an electrical power failure, the squirrel cage blower used to circulate cooling air across the test samples ceases to operate, and continued exposure to concentrated solar radiation without the benefit of