face is cancelled out and direct measurement or absolute of the reflectance of the specimen is obtained.

By eliminating any requirement for known surfaces for making comparative measurements of reflection, many of the uncertainties involved in calibration of the instrument with known surfaces are removed. The best previously known arrangement for making absolute measurements of reflection characteristics involved mounting a specimen in the center of an optical integrating sphere. Such a sphere is described in a paper in *Applied Optics*, Vol. 51, November 1961, at pages 1,279 to 1,288, entitled, "*Integrating Sphere for Imperfectly Diffuse Samples*" by D. K. Edwards, J. T. Geir, K. E. Nelson and R. D. Roddick. This paper also presents the mathematical theory of optical integrating spheres including the theoretical relationships for absolute and relative measurements of reflectance. The experimental arrangement of Edwards et al. with the specimen in the center of the sphere leads to substantial experimental difficulties when a plurality of specimens are to be measured since removing and replacing specimens in the center of the sphere is difficult, particularly in remote handling as in a vacuum system.

The improved optical sphere provided in practice of this invention permits absolute measurements to be made of the reflection characteristics of a surface with the specimen mounted in an aperture in the side of the optical integrating sphere. It is apparent that means are readily provided such as hereinabove described for changing specimens in the measuring aperture of the sphere so that numerous samples can be measured or samples can be measured before and after exposure to a simulated space environment. The integrating sphere herein described and illustrated with an opaque shield **120** between the photodetector and the directly illuminated portion on the wall of the sphere satisfies the theoretical relations for absolute reflectance measurements as set forth in the above mentioned Edwards et al. paper.

Referring again to FIGS. **1** to **4**, in operation of a simulation and measurement apparatus as provided in practice of this invention a plurality of specimens **27** are mounted on the raised specimen stations **43** on the disks **38** and secured in place by the spring clips **44.** Thermocouples **46** are placed against the specimens for measuring the temperature thereof and the thermocouple lead wires **49** wound through the spiral paths hereinabove described and thence out of the vacuum system for making temperature measurements. The vacuum system can then be sealed and the apparatus evacuated for producing a simulated space environment.

After a vacuum has been maintained for a selected time the specimens are sequentially placed in the measuring aperture **28** and the reflection characteristics of each determined by the optical techniques hereinabove described. Each specimen is in turn placed in front of the measuring aperture **28** by rotation of the support wheel **31** by means of the rotary motion seal **33** and by rotation of the specimen mounting disks **38** by the worm gear **56** connected to the rotary motion feedthrough **57.** After the optical characteristics of the specimens are obtained they are positioned in the exposure aperture **17** by rotation of the support wheel **31.** The ultraviolet source **18** and proton source **21** are adjusted to a desired intensity level and then the shutter **22** is swung into a position exposing specimens in the exposure aperture **17** to the flux from the ultraviolet source and proton source thereby simulating solar radiation falling on the specimens **27.** During exposure the temperature of the specimens may be controlled by contacting the reverse side of the mounting disk **38** with a heat sink **61** through which is circulated a heat transfer fluid.

After a selected exposure time the shutter **22** is swung back into position obscuring the exposure aperture and the solar simulating sources **18** and **21** are shut off. The specimens are then moved to the measurement aperture **28** again for further measurement of the reflectance to determine what changes, if any, have occurred due to exposure to vacuum and simulated solar radiation. It will be apparent that several cycles of such exposure can be provided and a variety of samples can be illuminated and tested under a variety of test conditions such as temperature, time, and radiation flux, in an apparatus as provided in practice of this invention, all without opening the vacuum system. It has been found that changes do occur in specimens due to exposure to gases after a simulated space environment, therefore it is desirable to perform the entire sequence of measurements in the vacuum simulating space.

Obviously many modifications and variations can be provided in practice of this invention. Thus, for example, other forms of support wheel and specimen mounting can be employed for specimens of a geometry different from the flat disks described herein. Other measurements than the optical reflectivity can be made at the measurement aperture and a variety of exposure arrangements may be employed.

What is claimed is:

1. In an evacuable simulator, an improved transport mechanism within the evacuable portion of the simulator comprising:

a support wheel;

a specimen mounting member on said support wheel, said specimen mounting member including means for mounting a plurality of separate specimens;

means for measuring the temperature of each of said specimens; and

means for moving said support wheel for transferring said specimen mounting member between a simulation station within the evacuable portion of the simulator and a measurement station also within the evacuable portion of the simulator.

2. In a simulator as defined in claim **1** an improved support wheel comprising:

a cruciform support member;

a pivotal mounting for said support member at the center of said cruciform, and between said simulation station and said measurement station;

a plurality of said specimen mounting members, one located at the end of each of the arms of the cruciform support member.

3. In a simulator as defined in claim **2** an improved specimen mounting member comprising:

a plate mounted at the end of each cruciform arm for rotary motion in the plane of the support member;

a plurality of specimen receiving locations on one face of said plate; and

a driven gear at the periphery of said plate; said simulator further comprising: