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44-60 ÅNGSTROM PHOTOMETER HAVING AN
ALUMINUM COATED MYLAR WINDOW
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FIG. 1

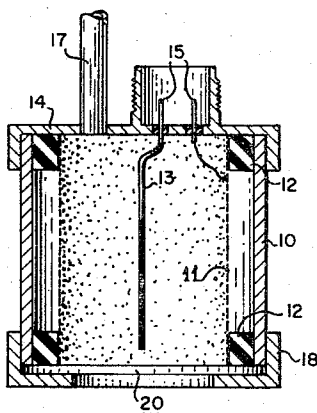
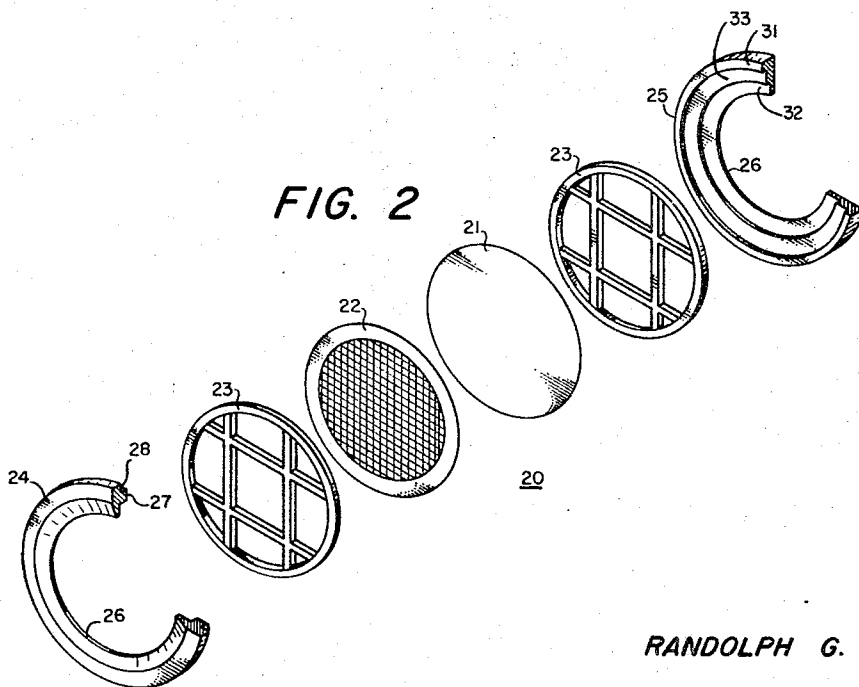


FIG. 2



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44-60 ANGSTROM PHOTOMETER HAVING AN ALUMINUM COATED MYLAR WINDOW

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1 Claim. (Cl. 313-93)

ABSTRACT OF THE DISCLOSURE

This invention is directed to an improved 44-60 Angstrom photometer operative to detect solar X-rays without any response to radiation below 44 Angstroms. The photometer is provided with an aluminum coated Mylar window and a gas filling in which the combination has a radiation cut-off at 44 Angstroms and at 60 Angstrom units. The aluminum coated Mylar prevents any gas leakage through the window and yet does not absorb sufficient radiation to affect detection of the desired radiation.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention is directed to a photometer and more particularly to an improved 44-60 Angstrom photometer.

Broad band photometers have been used in the past for the purpose of monitoring solar X-rays. These photometers are simple ionization chambers whose spectral sensitivity is dependent on gas filling and window characteristics. The window functions to pass radiation within a certain wavelength band. The gas mixture is disposed within the tube, wherein the gas mixture functions to limit operation of the tube to a desired upper wavelength. The gas mixture and window thereby provide the operational range for the tube between the lower wavelength cutoff of the window and the upper wavelength cutoff of the gas mixture. Heretofore, solar X-ray photometers have been used with a gas filling of 400 torr of nitrogen and fitted with a one-quarter mil thick window of Mylar polyester film to monitor 44-60 Angstrom solar radiation. This prior art photometer has the undesirable characteristic of being very responsive to radiation in the 2-15 Angstrom region. It is obvious to one skilled in the art that the gas could be changed to helium to avoid the undesirable response in the 2-15 Angstrom region. However, the Mylar window is permeable to helium at the pressures required to provide a radiation cutoff in the 2-15 Angstrom region. Therefore, in order to use helium as a gas, it is required to provide a window which will seal the helium gas within the tube and yet permit radiation of the desired wavelengths to pass through the window to avoid a response to radiation in the 2-15 Angstrom region.

It is therefore an object of the present invention to provide a photometer operative in the 44-60 Angstrom region.

Another object is to provide an inexpensive improved window for a photometer tube suitable for monitoring solar X-rays in the 44-60 Angstrom region.

Still another object is to provide a photometer tube which is of simple construction, durable and stable in use.

While still another object is to provide a sensitive photometer capable of detecting solar X-rays.

Further objects and advantages of the present invention will become apparent from a more careful study of the

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following detailed description of the accompanying drawing, in which:

FIG. 1 is a cross-sectional view of an X-ray photometer.

FIG. 2 represents an exploded view of the window assembly made in accordance with the present invention.

Now, referring to the drawing, there is shown in FIG. 1 a cross-sectional view of an X-ray photometer made in accordance with the present invention. The tube, as shown, includes an outer cylindrical housing 10 made of a material opaque to undesired radiation particles. A cylindrical anode 11 is secured within the housing in spaced relationship by an insulation material ring 12 at each end of the anode structure coaxial therewith. A cathode 13 is supported coaxially within the anode structure by an end enclosure 14 from which the cathode is insulated and connected with a suitable pin connection 15 on the outside of the tube. The anode is also connected to a separate and similar pin 15 on the outside of the tube in which the connection is insulated from the end closure. The end closure is also provided with a gas filler tube 17 which provides means through which desired gas filling may be added to the tube once the tube has been assembled ready for use. The opposite end of the tube is closed by a window assembly through which radiation is admitted into the tube to be detected. The window assembly is held in place by a flange 18 which is secured to the end of the housing with the window between the flange and the cylindrical housing.

FIG. 2 illustrates an exploded view of the window assembly which includes the window made in accordance with the present invention. The window 21 is formed of 0.25 mil Mylar or a similar material upon which a thin film of aluminum 1500 Angstroms in thickness has been evaporated or applied by any other method well-known in the art. The window is placed over a 20-line per inch nickel mesh 22 and is assembled between mesh supports 23 of the same diameter as the window and the nickel mesh. The window mesh support arrangement is assembled between front and rear cylindrical holders 24 and 25. Each of the holders are provided with an axial opening 26 which is of a smaller diameter than the aluminum coated window to permit radiation to enter through the window. The front holder has an axially extending rib 27 extending in the direction of holder 25 which provides a seat on the inner diameter thereof for the mesh support and an outer end 28 which seats against an outer rib 31 on the rear holder. The rear support member 25 is provided with two steps 32 and 33 of different diameter in which the mesh supports seats on step 32 and the rib 27 on holder 24 fits inside of the rib 31 and seats on the step 33. The rib 27 is formed so that the rib seats against step 33 with the end 28 seating against the rib 31 on the rear holder for the window. The window assembly is held together by any suitable sealing material or cement used in assembly of such phototubes.

The window assembly is held in place on the tube by an outer flange 18 which is secured to the body or housing. The flange that secures the window in place and the end enclosure 13 of the housing are secured to the housing by any suitable material or cement that will hold against the pressure of the additive gas within the tube.

The window assembly is shown with the nickel mesh on the outside of the aluminum coated Mylar window. Such an arrangement would be provided for a tube in which the gas pressure on the inside of the tube is greater than the operational pressure on the outside of the tube. In case the pressure on the outside of a tube is greater than the pressure on the inside thereof, then the nickel mesh would be placed to the rear of the aluminum coated Mylar window to prevent the window from being forced into the tube due to the high pressure on the outside thereof.

It is well known that Mylar or other such plastic materials used in the tube art is permeable to helium, water vapor, and many other gases. Any tube used heretofore in the prior art, making use of Mylar as a window and which has a problem of gas permeating the window by entering or escaping therefrom, can use the teaching of the present invention to apply an aluminum coating thereon to prevent the gas from entering or escaping from the tube.

The teaching of the present invention provides an improved 44-60 Angstrom solar X-ray photometer in which a gaseous filling of helium at a pressure of 400 mm. of Hg within the tube of 1 inch depth and 1 inch diameter may be used. The helium filling provides a photometer which is not responsive to radiation in the 2-20 Angstrom region such as the prior art tubes wherein the gases used were nitrogen at a filling of 400 torr. The combination of the aluminum coated Mylar window and helium provides a solar X-ray photometer operative in the 44-60 Angstrom area. The aluminum coated Mylar film prevents undesired gases from entering the tube and also prevents the helium gas from leaving the tube. A solar X-ray photometer made in accordance with the present invention permits one to obtain a direct output reading from the tube which is in the 44-60 Angstrom region with negligible interference from the spectral region between zero and 20 Angstrom units. Moreover, it has been determined that the aluminum film of about 1500 Angstrom units attenuates radiation in the 44-60 Angstrom band by approximately 50%.

Aluminum coatings of greater thickness will attenuate more radiation whereas an aluminum coating of less thickness will attenuate less than a 1500 Angstrom coating. Further, it has been determined that thinner aluminum coatings on Mylar will permit some helium gas to escape through the window and thicker coatings will completely prevent the gas from escaping. Thus, it can be seen that the thickness of the aluminum film on the Mylar window dictates the amount of attenuation and the rate at which gas will escape. Therefore, for operational requirements of short periods, the aluminum coating may be thinner with less attenuation of radiation. However, with long period operation, the aluminum film must be thicker with greater attenuation of the radiation. A film coating of 1500 Angstrom on the Mylar window will provide a photometer tube that will operate satisfactorily continuously for more than one year in a satellite or in other environment.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claim the invention may be practiced otherwise than as specifically described.

What is claimed and desired to be secured by Letters Patent of the United States is:

An improved 44-60 Angstrom unit photometer tube which comprises:

- a cylindrical housing opaque to radiation, said housing being closed at one end and open at the opposite end,
- a cylindrical anode within said housing coaxial therewith and insulated therefrom,
- a pin type electrical connector insulated from said closed end extending therefrom and connected electrically to said cylindrical anode,
- a cathode extending along the axis of said housing coaxial with said anode,
- a second pin type electrical connector insulated from said closed end, extending therefrom and connected electrically to said cathode on the inside of said housing,
- a radiation permeable Mylar window secured over the closed end of said housing in a gas tight manner, said Mylar having a thickness of about 0.25 mil, gas leakage prevention means coated onto said Mylar window,
- said gas leakage prevention means comprising an aluminum coating,
- said aluminum coating having a thickness of about 1500 Angstrom units,
- a gaseous filling of helium within said housing, said helium gaseous filling having a pressure of about 400 torr, and
- means secured to said housing for admitting said helium gaseous filling into said housing.

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