ABSTRACT OF THE DISCLOSURE

A Thermicon retina having a mesh support, an insulating smoke layer deposited thereon, an infrared absorbing gold black layer precipitated upon the outer surface of the smoke layer and a layer of thermally sensitive semiconductor material disposed on the outer surface of the gold black layer.

BACKGROUND OF THE INVENTION

This invention relates to a radiation sensitive device, and more particularly to a Thermicon retina or input screen for use in such a radiation sensitive device.

In certain types of thermally sensitive tubes such as described in Patent No. 3,082,340, entitled Radiation Sensitive Device, an infrared radiation image is directed on to an input screen. The infrared radiations are absorbed by a layer of infrared absorbing material and the thermal image thus formed in the layer is impressed on a semiconductive layer which exhibits a variation in electrical conductivity corresponding to the thermal image impressed thereon. The conductivity image set up in the semiconductive layer is then read by means of an electron beam to produce electrical signals in a well-known manner.

Conventional Thermicon retinas or input screens are usually fabricated by precipitating a thermally insulating smoke layer upon an infrared transmissive face plate or window support, followed by depositing an infrared absorbing layer such as gold black on the exposed surface of the smoke layer and further followed by a layer of thermally sensitive semiconductor material deposited on the exposed surface of the infrared absorbing layer.

The major problems encountered by the conventional Thermicon retina described above are as follows:

1. There is a formation of undesirable, large, uneven grain growth, or coalescing islands of smoke which encompass many raster lines;
2. It is usually of low resolution and sensitivity; and
3. It must be physically as well as electrically interconnected.

SUMMARY OF THE INVENTION

The inventive concept defined herein overcomes the existing problems encountered by the conventional Thermicon retina or input screen by utilizing a mesh or screen support on which various layers are deposited.

It is therefore the primary object of this invention to provide a Thermicon retina which prevents coalescing islands and large, uneven grain growth of the smoke particles as they precipitate onto a face plate or support.

It is a further object of this invention to provide a Thermicon retina which provides an enhancement in sensitivity and increase in resolution.

It is still another object of this invention to provide a Thermicon retina which is electrically connected, although it need not be continuously physically connected.

It is still a further object of this invention to provide a Thermicon retina which is economical to produce and which utilizes conventional, currently available components that lend themselves to standard mass production manufacturing techniques.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing.

DESCRIPTION OF THE DRAWING

In the drawing, wherein like reference numerals refer to comparable elements in the various figures:

FIGURE 1 represents an enlarged, detail cross-sectional view of the "theoretical" structure of a Thermicon retina or input screen;

FIGURE 2 represents an enlarged, detail cross-sectional view of a prior art Thermicon retina or input screen;

FIGURE 3 represents an enlarged, detail cross-sectional view of the Thermicon retina or input screen of this invention; and

FIGURE 4 represents a schematic representation, partially in section, of a conventional radiation sensitive device including the Thermicon retina or input screen of this invention.

DESCRIPTION OF THEORETICAL AND PRIOR ART DEVICES

Referring to FIGURE 1, there is shown a "theoretical" structure of a Thermicon retina or input screen. Such a Thermicon retina 10 comprises a support face plate or window 12, which allows infrared radiation to pass therethrough, followed by a thermally insulating layer 14 deposited on the inner surface of the window 12 with an infrared absorbing layer 16 such as gold black deposited on the exposed surface of the layer 14, and having a layer 18 of a thermally sensitive semiconductor material deposited on the exposed surface of the infrared absorbing layer 16—the layer 16 being in intimate thermal contact with layer 18.

Using the "theoretical" structure shown in FIGURE 1 as a basis, heretofore, an actual Thermicon retina or input screen 20 was constructed as follows.

Referring to FIGURE 2, a first thermally insulating smoke layer 24 is formed by precipitating smoke particles approximately one micron in diameter upon a surface of a face plate or window 12. After these particles precipitate on the surface of window 12 there is a movement along the surface so that a large and uneven grain growth results. The subsequent infrared absorbing layer of gold black 26 and thermosensor smoke or layer 28 of a thermally sensitive semiconductor material continues this uneven grain growth. The result is that when viewed upon a monitor a large grain is apparent. This nucleation of grain and grain growth is very difficult to control. Furthermore, when the radiation sensitive device or tube is operated, Joule heating in these grain particles, causes further large and uneven grain growth. This grain growth, or coalescing islands of smoke, are quite apparent in FIGURE 2. These grains may encompass many raster lines. Such a prior art, Thermicon retina or input screen 20, although operable, is of low resolution and sensitivity.

DESCRIPTION OF PREFERRED EMBODIMENT

The invention disclosed herein describes a new structure for a Thermicon retina or input screen, which prevents the above formation of large and uneven grain growth and which has an increase in sensitivity and resolution.

Referring to FIGURE 3, there is shown the Thermicon retina or input screen 22 of this invention. As a support there is shown a mesh or screen 24 which allows transmission of infrared radiation. This mesh or screen 24 is preferably of aluminum oxide and has approximately 500 to 750 mesh to the inch and is formed by anodizing,
for example, an aluminum screen. Upon this mesh or screen 24 is then precipitated the first smoke which is an insulating smoke layer 14 such as antimony trisulfide, arsenic trisulfide or barium fluoride. The only other necessary requirement for this smoke layer 14 is that it be transmissive to infrared radiation in the particular portion of the infrared spectrum which is to be detected. As can be seen, the smoke layer 14 necessarily must precipitate in the area between the holes or openings 26 of mesh or screen 24. These openings 26 prevent movement of the smoke particles along the surface, thus preventing large and uneven grain growth, and producing a smooth even surface.

Furthermore, as indicated in FIGURE 3, an infrared absorbing layer 16 such as gold black is precipitated upon the outer surface of layer 14 and is in turn also prevented from forming large coalesced islands. Gradually, the areas of holes 26 between the mesh are filled in, preferably by a third layer 18 of thermally sensitive semiconductor material. The semiconductor material has the property of varying its electrical conductivity in response to thermal excitation.

The resulting structure is one which prevents the grain coalescing initially, and subsequently prevents formation of grains that may be the size of many raster lines. These holes or openings 26 in the gold black layer 16 also prevent thermal spread. A further advantage of the Thermicon retina or input screen 22 of this invention (shown in FIGURE 3) is that the gold black layer 16, although electrically connected, need not be continuously physically connected.

MODE OF OPERATION

Referring to FIGURE 4, in operation the Thermicon retina or input screen 22 is located within a conventional radiation sensitive device 28.

An evacuated vacuum tight enclosure 30 of a suitable material such as glass is utilized to enclose the thermally sensitive retina or screen 22 and the associated electronic beam scanning system.

The vacuum envelope 30 has an input window 34 at one end which is of a suitably wide band transmitting material such as silver chloride, barium fluoride or calcium fluoride.

An electron gun 36 of any suitable type is provided at the opposite end of the envelope 30 to scan the exposed surface of the semiconductor layer 18. The gun 36 consists of a cathode 38, a control grid 40, an accelerating grid 42 and an anode 44. The control grid 40 may operate from zero to a negative 100 volts with respect to cathode 38. The anode structure 44 extends from the accelerating grid 42 to the vicinity of the retina or input screen 22 and controls the potential of most of the space through which the electron beam 32 moves from the cathode 38 to the input screen 22. The anode 44 is operated at a positive potential of slightly less than 300 volts with respect to cathode 38.

In the specific device shown, the anode 44 is composed of two tubular sections 46 and 48. The section 48 is the und portion of the anode 44 and is of a good heat conductive material such as copper. The remaining section 46 of the anode 44 is of a material such as Nichrome. It is necessary that the section 46 be of a non-magnetic material such as Nichrome in order not to interfere with the magnetic field used. A diaphragm 50 is provided in the section 48 near the adjacent cathode 38. The diaphragm has a centrally located aperture 52 provided therein. This diaphragm provides means of shielding radiation generated at the cathode 38 from the input screen 12.

The Thermicon retina or input screen 22 is positioned within extension 54 and near the open end of section 48. The input screen 22 is electrically insulated (not shown) from the anode 44 and extension 54. An electrical lead is provided from the layer 16 of the retina or input screen 22 to an electrically conductive ring (not shown) to provide an external connection.

Positioned on the exterior portion of the envelope 30, there is provided an alignment coil, a focusing coil and also a horizontal and vertical deflection coil, all illustrated as 56, for focusing and deflecting the electron beam 32 in a predetermined raster over the surface of retina or input screen 22.

Positioned exterior to the envelope 30 and in front of the input window 34 is a suitable optical system represented by lens or mirror 58 for focusing the infrared radiation from a scene onto the input screen 22. A more complete description of the tube and its operation is found in the previously mentioned Patent No. 3,082,340.

In this embodiment, radiations from a scene are projected onto the thermally sensitive retina or input screen 22 and translated into a distributed charge image on the Thermicon retina or screen 22. The electron beam 32 is utilized to read the charge image and convert the charge image into electric signals for transmission.

Thus, by introducing a novel support surface of mesh configuration, an improved Thermicon retina or target screen structure has been developed which prevents coalescing and grain growth of the smoke particles into excessively large grains and which produces a Thermicon retina of high sensitivity and resolution.

Although the invention has been described with reference to a particular embodiment, it will be understood to those skilled in the art that the invention is capable of a variety of alternative embodiments within the spirit and scope of the appended claims.

1. In a radiation sensitive device having a vacuum envelope, a window which permits the transmission of infrared radiation, an electron gun and a Thermicon retina positioned between said window and said electron gun, the improvement therein comprising a Thermicon retina having an infrared transmissive mesh support, said mesh support having approximately 500-750 mesh to the inch, a smoke-like, thermally insulating layer disposed on the inner surface of said mesh support and positioned between said electron gun and said mesh support, an infrared absorbing layer adjacent the surface of said thermally insulating layer and spaced from said mesh support and a semiconductor layer disposed on the surface of said infrared absorbing layer, said semiconductor layer being of material that exhibits the property of variation of electrical conductivity in response to thermal excitation.

2. In a radiation sensitive device as defined in claim 1 wherein the mesh of said support is aluminum oxide.

3. In a radiation sensitive device as defined in claim 2 wherein said thermally insulating smoke layer is antimony trisulfide and is transmissive to infrared radiation.

4. In a radiation sensitive device as defined in claim 3 wherein said infrared absorbing layer is gold black.

References Cited

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