

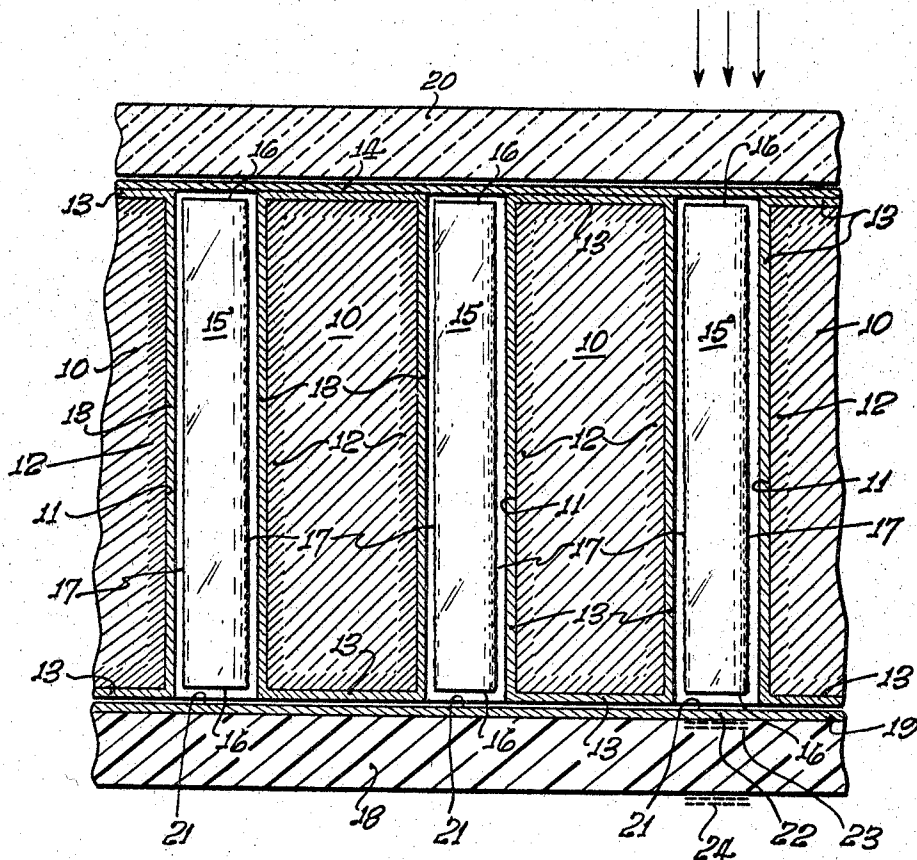
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W. HOTINE

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INFRARED SENSITIVE PHOTOCONDUCTIVE MATRIX

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INVENTOR.

WILLIAM HOTINE,

By

John H. Haysburg

ATTORNEY.

L E Carnahan

AGENT.

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INFRARED SENSITIVE PHOTOCONDUCTIVE MATRIX

William Hotine, Albion, Calif., assignor to General Dynamics Corporation, a corporation of Delaware
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7 Claims

ABSTRACT OF THE DISCLOSURE

An infrared sensitive photoconductive matrix using a honeycomb base having holes filled with infrared transmitting and side-radiating fibers.

Apparatus for converting light images into electrostatic images are known in the art. However, such prior known systems have been known to be expensive. While the present invention relates generally to this field of art, it provides advantages not previously known, particularly with respect to electrostatically controlled vapor plating processes.

An object of the invention is to provide an infrared sensitive photoconductive matrix.

A further object of the invention is to provide an infrared sensitive photoconductive honeycomb type of matrix suitable for use in electrostatically controlled vapor plating processes.

These and other objects of the invention, not specifically set forth above, will become readily apparent from the following description and accompanying drawing wherein:

The single figure is a partial cross-sectional view illustrating the structure of the invention.

Broadly, the invention relates to the photoconductive structure, the invention providing an improved photoconductive matrix honeycomb capable of easy fabrication which utilizes transparent optical fibers capable of radiation from their sides, placed in honeycomb holes lined with a photoconductive layer. Infrared radiation impinging on the end of an optical fiber in a hole will be radiated from the sides of the fiber, illuminating the photoconductive layer on the side of the hole and changing its resistance. A conductive path through the honeycomb is thereby supplied at the position of the illuminated hole.

Referring now to the drawing, which is a sectional view of an embodiment of the invention, an aluminum plate 10 is provided with numerous through holes or apertures 11. An insulating layer 12 of aluminum oxide extends over the entire surface of plate 10 and the holes 11. A photoconductive layer 13 of lead sulphide covers the aluminum oxide insulating layer 12. A metallic electrode ohmic connection layer 14 is positioned on the upper surface of the plate 10. An optical fiber comprising a small rod 15 of arsenic trisulphide or other suitable material is located in each of the holes 11. The rods 15 are of a length slightly less than the thickness of the aluminum honeycomb plate 10. The ends 16 of the rods 15 are finished smooth while the sides 17 of the rods are roughened by sandblasting, for instance. A dielectric under layer 18 is coated on its upper surface with a layer 19 of lead sulphide, layer 19 being placed against the lower side of the aluminum honeycomb plate 10. An infrared transparent layer 20 of suitable material is placed against the upper side of the electrode layer 14. The layers 18 and 20 serve to retain the rods 15 in the holes 11 of plate 10 and are suitably attached to the plate, layers 18 and 20 being shown slightly separated from plate 10 for clarity.

In operation, infrared illumination, indicated by ar-

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rows, shining down on the assembly illustrated in the drawing passes through the transparent layer 20 and impinges on the ends 16 of rods 15. The radiation scatters through the rod 15 and emerges through the sides 17, which, as set forth above, have been sandblasted to a rough surface which does not reflect the radiation internally like a normal type of optical fiber. The infrared radiation emerging from the sides 17 of the rods 15 impinges on the lead sulphide layer 13 which lines the surface of the holes 11, thus changing the electrical conductivity of layer 13 and making a conductive path through the hole 11 from the electrode layer 14 to the bottom of the hole as indicated at 21. Illumination from the end 16 of rod 15 forms a conductive spot 22 on lead sulphide layer 19 at the lower end 21 of hole 11. This conductive spot 22 by means of conductive layer 14, furnishes an electrostatic charge 23 to dielectric layer 18. This charge 23 will travel to the under surface of layer 18 as indicated at 24 and will attract oppositely charged droplets of plating solution, for example.

The method for fabricating the above described infrared sensitive photoconductive matrix comprises the following steps:

(1) Anodize the aluminum plate 10 having through holes 11 so as to form the insulating layer 12 of aluminum oxide over the entire surface of the aluminum, including the sides of the holes;

(2) Chemically deposit the photoconductive layer 13 of lead sulphide over the entire anodized honeycomb surface;

(3) Mask the holes 11 and deposit by evaporation techniques the electrode layer 14 on the upper surface of the plate 10 over the lead sulphide layer 13;

(4) Remove the hole masking material and insert the small radiant energy transmitting rods 15 into each hole 11, the rods being of a length slightly less than the thickness of the plate and provided with smooth ends and roughened sides;

(5) Apply a lead sulphide coated dielectric layer 18 against the lower side of the honeycomb 10 with the lead sulphide coating 19 being immediately adjacent the lower ends of the rods 15; and

(6) Apply an infrared transparent layer 20 of material against the upper surface of the electrode layer 14, whereby the layers 18 and 20 serve to retain the rods 15 in place.

While the structure of the invention has been above described as being particularly applicable to electrostatically controlled vapor plating processes, variations of the materials provide numerous other applications of the inventive concept. It may, for example, be used to make an image converter or light amplifier by use of suitable materials. In addition, the above described function can be reversed wherein the matrix is digitally energized to select a spot which emits light, as in the display with a variation in construction in which a phosphor is used.

Also, it may be used for so-called "panelescent" illuminated displays, and electronically controlled by digital computer techniques to provide a solid state flat picture frame type of visual display. Inversely, it may provide an electrical output for an illuminated picture input, such as in a TV camera. Solid state camera and picture tubes utilizing this invention can occupy a flat framelike space, can be scanned with solid state digital techniques thus dispensing with vacuum envelopes, electron beams, focusing limitations and magnetic susceptibility. Resolution may be as fine as the honeycomb structure can be practically fabricated. For example, the holes may have a 0.002 inch diameter and spaced 0.003 inch apart, thus enabling a 300 mesh screen resolution.

Other applications of this invention include multiplexing and missile guidance. For example, a solid state digital

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missile guidance package of less than a cubic inch could positionally sense infrared target energy focused on the matrix, and pulse width modulate a gas operated reaction wheel with the off-center count thus providing an anticipatory flight path to the target. The aluminum honeycomb of this invention may be readily cooled to increase IR sensitivity.

The above mentioned additional applications for the structure would employ suitable electrode layers and suitable dielectric or phosphor layers in variations of the inventive structure for the specific purposes for which it was utilized.

It has thus been shown that this invention provides an improved structure and method of construction of an infrared sensitive photoconductive matrix which utilizes an anodized aluminum honeycomb having holes filled with infrared transmitting, side radiating optical fibers.

Although a particular embodiment of the invention has been illustrated and described, modifications will become apparent to those skilled in the art, and it is intended to cover in the appended claims all such modifications as come within the true spirit and scope of the invention.

What I claim is:

1. An infrared sensitive photoconductive matrix comprising: A metallic plate having a plurality of apertures extending therethrough, an insulating layer of suitable material covering the surface of said metallic plate and the sides of said apertures, a layer of photoconductive material positioned over said insulating layer, a layer of suitable metallic material defining an electrode positioned on one surface of said metallic plate, a radiant energy transmitting member positioned in each of said apertures, said members being provided with smooth end surfaces and roughened side surfaces, a layer of dielectric material coated with a suitable conductive material on one surface thereof positioned on the surface of said metallic plate opposite said electrode such that said conductive coating is adjacent said metallic plate, and a layer

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of infrared transparent material positioned adjacent said electrode.

2. The photoconductive matrix defined in claim 1, where said metallic plate is composed of aluminum.

3. The photoconductive matrix defined in claim 1, wherein said insulating layer is composed of aluminum oxide.

4. The photoconductive matrix defined in claim 1, wherein said layer photoconductive material is composed of lead sulphide.

5. The photoconductive matrix defined in claim 1, wherein said energy transmitting members are constructed from arsenic trisulphide.

6. The photoconductive matrix defined in claim 1, wherein said conductive coating is composed of lead sulphide.

7. The infrared sensitive photoconductive matrix defined in claim 1, wherein said metallic plate is composed of aluminum, said insulating layer is composed of aluminum oxide, each of said photoconductive material and said conductive coating is composed of lead sulphide, and said energy transmitting members are optical fiber rods composed of arsenic trisulphide.

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RALPH G. NILSON, *Primary Examiner.*

SAUL ELBAUM, *Assistant Examiner.*

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