United States Patent [19]

Wilson

[11] **3,922,578**

[45] **Nov. 25, 1975**

[54] **LARGE AREA CATHODE**

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[22] Filed: **May 1, 1974**

[21] Appl. No.: **465,860**

[52] **U.S. Cl.** **313/278**; 313/343

[51] **Int. Cl.²** **H01J 1/94**; H01K 1/18

[58] **Field of Search** 313/341, 343, 278

[56] **References Cited**

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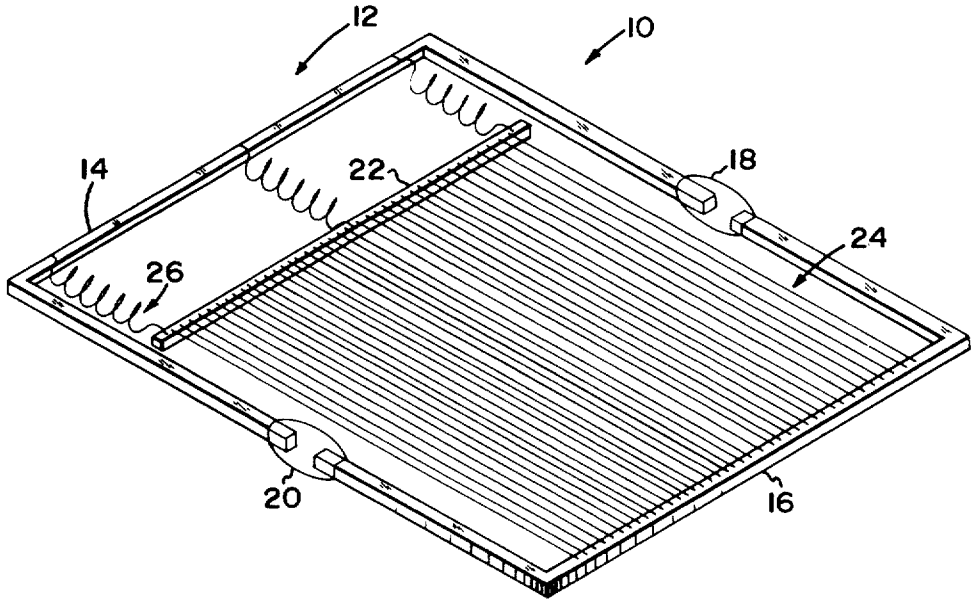
[57] **ABSTRACT**

A large area cathode comprises a main peripheral frame composed of two sections joined together by an electrically insulating material whereby each section is electrically isolated from the other. A secondary frame is mounted within the main frame and carries a large plurality of directly heated cathode wires extending between one section of the main frame and the secondary frame and are affixed thereto. Tensioning means extend between the secondary frame and the other section of the main frame.

5 Claims, 2 Drawing Figures



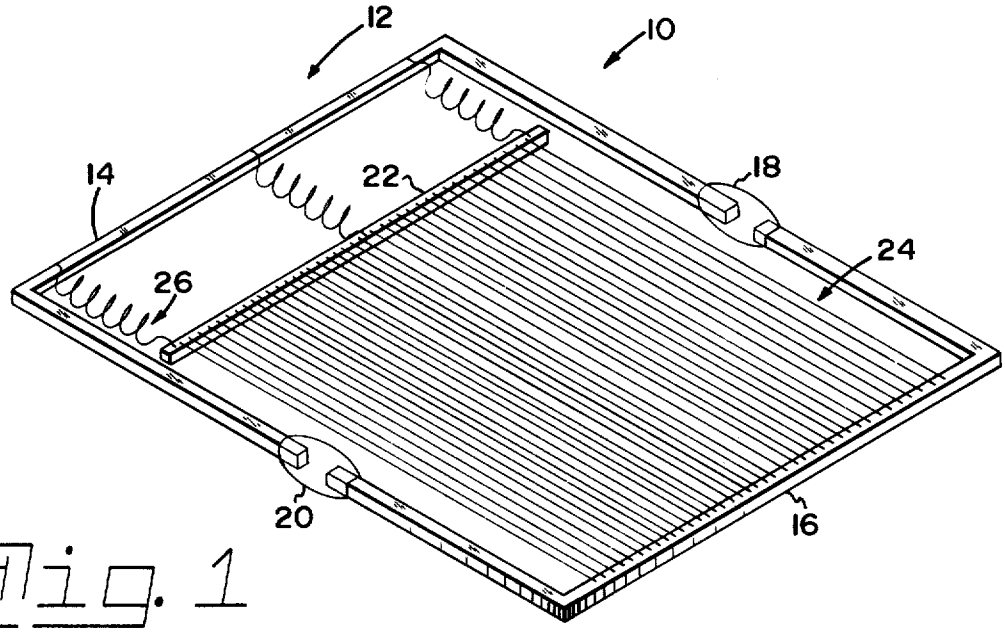


Fig. 1

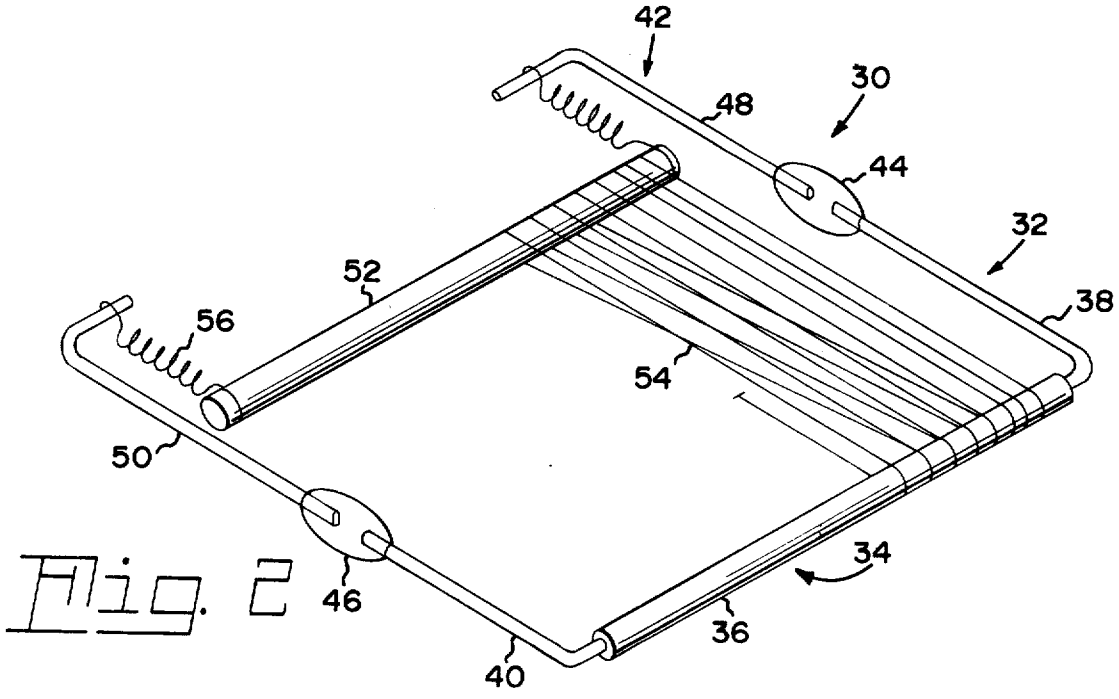


Fig. 2

LARGE AREA CATHODE

BACKGROUND OF THE INVENTION

This invention relates to electron emitting cathodes and primarily to large area electron emitting cathodes. Such large area cathodes are a necessary and vital component in electron beam scanning devices of the type described in U.S. Pat. No. 3,539,719.

Prior attempts to formulate a large area cathode have been largely unsuccessful. These prior attempts have attempted to use existing cathode technology and have run into many problems. For example, one of the first attempts was to sinter a tungsten heater wire to a large nickel sheet and then coat the sheet with a cathode material. This attempt was doomed to failure because of the differences in the coefficient of expansion between the nickel and the tungsten. When operated for any length of time, it was found that the cathode bowed.

Another attempt that has been utilized was to put heater wires into corrugated receptacles spot welded to one side of a nickel sheet. The opposite side of the nickel sheet was then coated with a cathode material. This attempt also proved unsuccessful because excessive heat was developed and excessive current was drawn.

It is believed an advance in the art if a successful large area cathode for use with the electron beam scanning devices described above could be manufactured.

OBJECTS AND SUMMARY OF THE INVENTION

It is, therefore, an object of the invention to obviate the disadvantages of the prior art.

It is another object of the invention to enhance the operation of large area cathodes.

It is yet another object of the invention to provide a large area cathode which works well with the electron beam scanning devices described in the above-named patent.

These objects are accomplished in one aspect of the invention by the provision of the large area cathode which comprises a main peripheral frame composed of two sections joined together by an electrically insulated material whereby each section is electrically isolated from the other. A secondary frame is mounted within the main frame and carries a large plurality of directly heated cathode wires which extend between the secondary frame and one section of the main frame. Tensioning means are provided which extend between the secondary frame and the other section of the main frame to maintain sufficient tension on the cathode wires during operation. Without some form of tensioning means, the cathode wires sag during operation, and such sagging adversely effects the operation thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of one embodiment of the invention; and

FIg. 2 is a similar perspective view illustrating an alternate embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For a better understanding of the present invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following disclosure and appended claims taken in conjunction with the above described drawings.

Referring now to the drawings with greater particularity, there is shown in FIg. 1 a large area cathode **10** comprised of a main frame **12** of a suitable metallic or electrically conductive material. The main frame **12** is comprised of two sections **14** and **16** joined together by electrically insulating elements **18** and **20** of a suitable material. The electrically insulating material can be glass or ceramic or other suitable material having the proper electrical insulating properties and mechanical strength necessary to maintain alignment of the two sections of the frame. A secondary frame **22**, which in this instance comprises an electrically conductive bar having a length sufficient to fit within the internal dimension of the main frame, is positioned with frame **12**. Attached to the secondary frame **22** and the first section **16** of the main frame are a plurality of directly heated cathode wires **24**, each individually attached at one end to frame **16** and the other end to frame **20**. To maintain the proper tension on the cathode wires **24**, a plurality of tensioning means **26** are attached to the secondary frame **22** and the second or other part of the main frame **14**. The tensioning means should be far fewer in number than the cathode wires and in at least one practical application, it has been found that three are sufficient. The tensioning means are preferably in the form of stretched coil springs.

It will be seen from the above description that there is here provided a large area cathode that is relatively simple and economical to fabricate and yet provides its designed purpose adequately. The plurality of directly heated cathode wires provides a large area array of electrons when in operation. The plural frame concept, together with the tensioning means provided insures that the cathode wires are maintained at a proper tension even during operation. It is of course to be realized that during operation of the cathode, the individual cathode wires attain a high temperature and, because of this, elongate due to thermal expansion. Absent the tensioning means, the cathodes would sag and adversely effect operation of the device.

Referring now to FIG. 2, there is shown an alternate construction of a large area cathode **30**. Large area cathode **30** also is provided with a main frame **32**. A first section **34** of the main frame in this embodiment is comprised of a substantially cylindrical electrically insulating rod of a suitable material such as a ceramic. The extreme ends of the rod **36** are provided with centrally located apertures extending along the longitudinal axis thereof and are provided with L-shaped metallic rods **38** and **40** respectively. The terminal ends of rods **38** and **40** are joined to the second portion of the main frame **42**, again by electrically insulating components **44** and **46** of a suitable material such as glass or ceramic, as described above in regard to the embodiment of FIG. **1**. Extending from the insulating components **44** and **46**, are substantially similar L-shaped metallic rods **48** and **50** respectively. The secondary frame **52** is mounted in a manner similar to that of the secondary frame in FIG. **1** but in this instance, secondary frame **52** comprises a substantially cylindrical elongated ceramic rod. Instead of the plurality of separate cathode wires as in FIG. **1**, a single helically wound cathode comprised of a large plurality of turns is provided between the two ceramic rods **36** and **52**. Tensioning means **56** are likewise provided in this embodiment and can be in the form of coiled springs which extend between the secondary frame **52** and the second section of the main frame. In this particular instance,

two springs are required and extend between secondary frame **52** and element **48** and secondary frame **52** and element **50.**

Again, there is provided a large area cathode which is simple and economical to fabricate. The helically wound heater wire can be fabricated using known grid winding techniques. The simple yet effective tensioning means provided insures that cathode sag during operation is eliminated.

While there have been shown what are at present considered to be the preferred embodiments of the invention, it will be apparent to those skilled in the art that various changes and modifications can be made herein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. A large area cathode comprising: a main peripheral frame comprised of two sections joined together by an electrically insulating material whereby each section is electrically isolated from the other; a secondary frame mounted within said main frame; a large plurality of directly heated cathode wires extending between

one section of said main frame and said secondary frame and affixed thereto; and tensioning means extending between said secondary frame and the other section of said main frame.

2. The cathode of claim **1** wherein said tensioning means are far fewer in number than said cathode wires.

3. The cathode of claim **2** wherein said one section of said main frame and said secondary frame are electrically conductive.

4. The cathode of claim **3** wherein said large plurality of directly heated cathode wires are each individually bonded to said one section of said main frame and said secondary frame in an electrically conductive relationship.

5. The cathode of claim **2** wherein said one section of said main frame and said secondary frame are formed from an electrically insulating material and said large plurality of directed heated cathode wires are formed from the turns of a single helix wound about said one section of said main frame and said secondary frame.

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