June 16, 1942. P. T. FARNSWORTH 2,286,478

METHOD OF MANUFACTURING A CATHODE RAY TUBE TARGET

Filed Dec. 27, 1940

FIG. 1

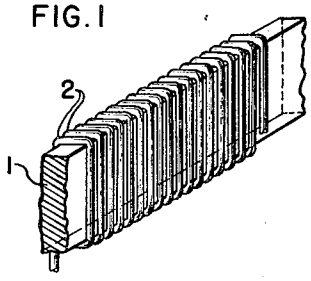


FIG. 2

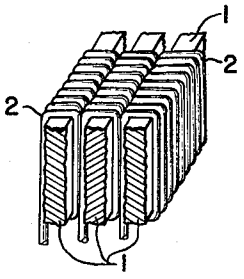


FIG. 3

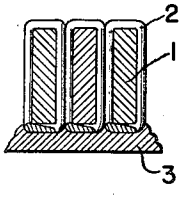


FIG. 4

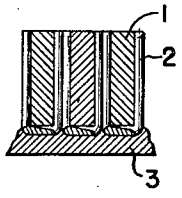


FIG. 5

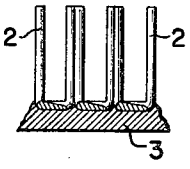


FIG. 6

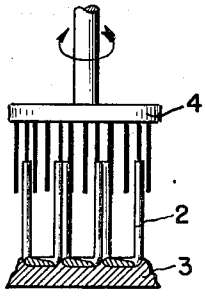


FIG. 7

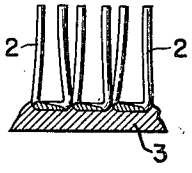
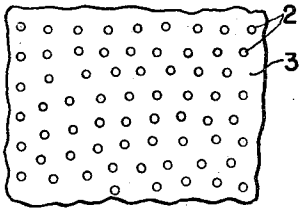


FIG. 8



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METHOD OF MANUFACTURING CATHODE-RAY TUBE TARGETS

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Application December 27, 1940, Serial No. 371,935

4 Claims. (Cl. 250—164)

This invention relates to a cathode ray tube target and a method of manufacturing the same, and more particularly relates to a target adapted to be heated to incandescence by electron bombardment and to remain in this condition for a predetermined length of time.

Conventional cathode ray tubes employ a fluorescent screen as a target, which is excited to luminescence by bombardment with an electron beam. In television, the electron beam of the cathode ray tube is scanned across the fluorescent screen target in accordance with a predetermined pattern and is modulated in accordance with a television picture signal, thereby to reproduce a luminescent image on the fluorescent screen. The desire for larger television images has heretofore generally necessitated the construction of proportionately larger cathode ray tubes. Such large tubes, however, are extremely bulky as well as dangerous because of the likelihood of implosion, for which reasons limits are reached, beyond which it is impractical to increase the size of the cathode ray tube in order to increase the size of the television image.

It has been proposed to use a relatively small cathode ray tube for the purpose of developing an extremely bright image on the fluorescent screen thereof and to project this image by optical means upon a viewing screen, thereby to provide an enlarged television image. In order to develop such a relatively small television image of extreme brightness, however, it is necessary to generate in the cathode ray tube an electron beam of extremely high power and very small cross section. With such intense electron bombardment, the life of the fluorescent picture screen, as well as the cathode of the electron gun, is relatively short and the tube becomes inefficient and produces dim pictures after a comparatively short period of operation.

The object of the present invention is to provide a new and improved cathode ray tube target and method of manufacturing the same, whereby images of high brilliancy may be produced over a relatively long period of operation.

Another object of the present invention is to provide a cathode ray tube target and method of manufacturing the same, which target is adapted to be heated to incandescence within a predetermined time by electron bombardment and to remain incandescent for a suitable length of time thereafter.

In accordance with the present invention, there is provided a cathode ray tube target comprising a metallic backing and a plurality of refractory elements, adapted to be heated to incandescence within a predetermined period by electron bombardment and adapted to remain incandescent for another predetermined period. The refractory elements are secured to the metallic backing in spaced relation and extend therefrom to provide a brush-like structure.

In accordance with the present invention, such a target is manufactured by winding refractory thread about elongated supporting material and arranging this material in such a manner as to provide a plurality of adjacent strips thereof. A metallic backing is applied to the arranged strips to provide a unitary structure. Portions of the threads on the surface of the structure opposite the backing are removed, and finally the supporting material is also removed from the structure so that the latter assumes a brush-like appearance.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the accompanying drawing, all of which are greatly enlarged views:

Fig. 1 is a perspective view of a section of elongated supporting material about which a thread of refractory material is wound;

Fig. 2 is a perspective view of the supporting material arranged to provide a plurality of adjacent strips thereof carrying windings of refractory thread;

Fig. 3 shows a section through several strips of supporting material carrying refractory thread to which a metallic backing has been applied;

Fig. 4 shows the same cross section as Fig. 3 after portions of refractory thread have been removed;

Fig. 5 shows the same cross section as Fig. 4 after the supporting material has been removed;

Fig. 6 illustrates the application of a rotating wire brush to the brush-like target structure;

Fig. 7 shows a cross section through several strips of the finished target corresponding to that of Fig. 3; and

Fig. 8 is a fragmentary plan view of the completed target in which the thread ends are indicated by the small circles.

Referring now more particularly to Fig. 1 of the drawing, there is shown a section of elongated supporting material 1, preferably of copper, having a cross section of 0.02 inch by 0.001 inch, about which is wound a thread 2 of refrac-

tory material, preferably of tungsten wire, having a diameter of 0.00125 centimeter. A plurality of strips of supporting material 1 carrying windings of the thread 2 may be cut, or a long piece thereof folded and arranged in such a manner as to provide a plurality of adjacent strips, as shown in Fig. 2. The adjacent strips are held together by any suitable conventional form or tool (not shown) and a metal backing 3 is applied to one side of the strips to produce a unitary structure, as shown in cross section in Fig. 3. The metal backing preferably consists of nickel, may be applied by evaporation or electroplating, and is given a thickness of between 0.002 and 0.01 inch to provide a rigid support for the thread 2.

The side of the unitary structure opposite the backing 3 is then subjected to abrasion, by grinding or lapping, until the free ends of the loops of the thread 2 are cut open, as shown in Fig. 4. To this structure there then is applied a solution capable of dissolving the copper supporting material 1, preferably a solution of salt of potassium, such as potassium nitrate, potassium bromide, potassium cyanide, or any other suitable material. This solution dissolves the copper supporting material but does not attack the tungsten thread or the nickel backing. After dissolving substantially all supporting material, a structure is obtained as shown in Fig. 5.

As will be seen from Fig. 5, the free ends of thread 2 are not equally spaced and form a distinct pattern. For television purposes, it is preferable to have the free ends of thread 2 substantially equally spaced from each other. For this purpose, the wires of a small wire brush 4, as shown in Fig. 6, may be inserted between the free ends of the threads of the target structure and rotated as indicated by the arrow. Preferably, the brush 4 is fixed in a drill press and rotated thereby, while the target structure can be moved about so as to eventually subject the entire area of the target structure to the action of the rotating brush 4. This brush causes the free thread ends to be bent and a random distribution in space thereof is obtained, which approximates a uniform spacing. Fig. 7 shows a section of the completed target illustrating equally-spaced thread ends, while Fig. 8 shows fragmentally the target in plan view, as may be observed through a microscope, the small circles indicating the random distribution of the free ends of the thread 2.

While there has been described a cathode-ray tube target comprising tungsten wire ends supported by a metal backing, preferably of nickel, it is also possible to manufacture by a slightly modified process a cathode-ray target comprising minute rods of lanthanum oxide. Such a target is produced by winding rayon thread around strips of soluble material, and arranging these strips, carrying the rayon thread adjacent one another. Metal is then evaporated on one side of the strips and the metal film so produced is reinforced by electro-plating, thereby to provide a rigid metallic backing. Thereafter, the portions of the turns of thread opposite to the metal backing are cut open and the strips of soluble material are dissolved in a proper solvent. The free ends of the rayon pile so produced are then preferably dipped in lanthanum chloride and later exposed to heat whereby the rayon is burned and a target comprising a multitude of fine rods of lanthanum oxide is produced.

For use in television, the finished target is incorporated in a cathode-ray tube and scanned by an electron beam modulated in accordance with a picture signal. The electron beam impinges upon the free ends of thread in successive order in accordance with a scanning pattern, and raises their temperature to incandescence within the short time of electron impact. Losses by conduction and radiation being small, the state of incandescence persists over a predetermined period so that a storage effect is gained, as is well known in the art. In this manner, a small and extremely bright incandescent television image is produced which can be projected by means of an optical system upon a screen to develop thereon a bright and enlarged television image.

While there has been described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. The method of manufacturing a cathode ray tube target which comprises winding thread of incandescent material about elongated supporting material, arranging said supporting material to provide a plurality of adjacent strips thereof, applying a metallic backing to said arranged strips to provide a unitary structure, removing portions of said thread at the surface of said structure opposite said backing, and removing at least a part of said supporting material from said structure.

2. The method of manufacturing a cathode ray tube target which comprises winding thread of incandescent material about elongated supporting material, arranging said supporting material to provide a plurality of adjacent strips thereof, applying a metallic backing to said arranged strips to provide a unitary structure, removing portions of said thread at the surface of said structure opposite said backing, and removing by dissolution in a solvent at least a part of said supporting material from said structure.

3. The method of manufacturing a cathode ray tube target which comprises winding thread of incandescent material about elongated supporting material, arranging said supporting material to provide a plurality of adjacent strips thereof, applying a metallic backing to said arranged strips to provide a unitary structure, removing by abrasion portions of said thread at the surface of said structure opposite said backing, and removing at least a part of said supporting material from said structure.

4. The method of manufacturing a cathode ray tube target which comprises winding thread of incandescent material about elongated supporting material, arranging said supporting material to provide a plurality of adjacent strips thereof, applying a metallic backing to said arranged strips to provide a unitary structure, removing portions of said thread at the surface of said structure opposite said backing, removing said supporting material from said structure, and spacing the free ends of said thread to obtain substantially uniform spacing thereof.

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