United States Patent [19]

Ornstein

[11] **3,838,985**

[45] **Oct. 1, 1974**

[54] **COMPOSITE THREE LAYER METAL THERMOSTAT**

[75] Inventor: **Jacob L. Ornstein**, Norton, Mass.

[73] Assignee: **Texas Instruments Incorporated**, Dallas, Tex.

[22] Filed: **June 8, 1973**

[21] Appl. No.: **368,422**

Related U.S. Application Data

[62] Division of Ser. No. 278,335, Aug. 7, 1972, Pat. No. 3,781,583.

[52] **U.S. Cl.** **29/195.5**

[51] **Int. Cl.** **B32b 15/00**

[58] **Field of Search** 29/195.5

[56] **References Cited**

UNITED STATES PATENTS

2,240,824	5/1941	Alban	29/195.5
2,470,753	5/1949	Alban	29/195.5
3,378,357	4/1968	Alban	29/195.5
3,454,373	4/1968	Ornstein	29/195.5
3,563,712	2/1971	Zeigler	29/195.5

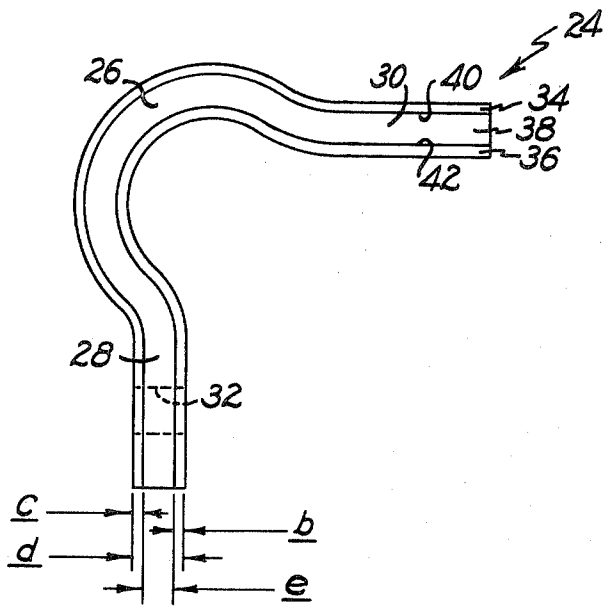
Primary Examiner—Hyland Bizot

Attorney, Agent, or Firm—Harold Levine; John A. Haug; James P. McAndrews

[57] **ABSTRACT**

A support arrangement for the shadow mask in a color television tube of slim design is shown to include a plurality of support members formed of a low cost thermostat metal embodying only iron alloy materials, which thermostat metal displays high strength and corrosion resistance at elevated temperatures and displays low flexivity and stable thermal response properties, the thermostat metal having outer metal layers of approximately equal thickness formed of nickel-chromium-iron and nickel-iron alloys respectively and having an intermediate layer of selected stainless steel comprising between 45 and 65 percent of the total thickness of the thermostat metal providing the thermostat metal with a flexivity in the range from 90 to 110 in the temperature range from room temperature up to about 350°F.

2 Claims, 3 Drawing Figures



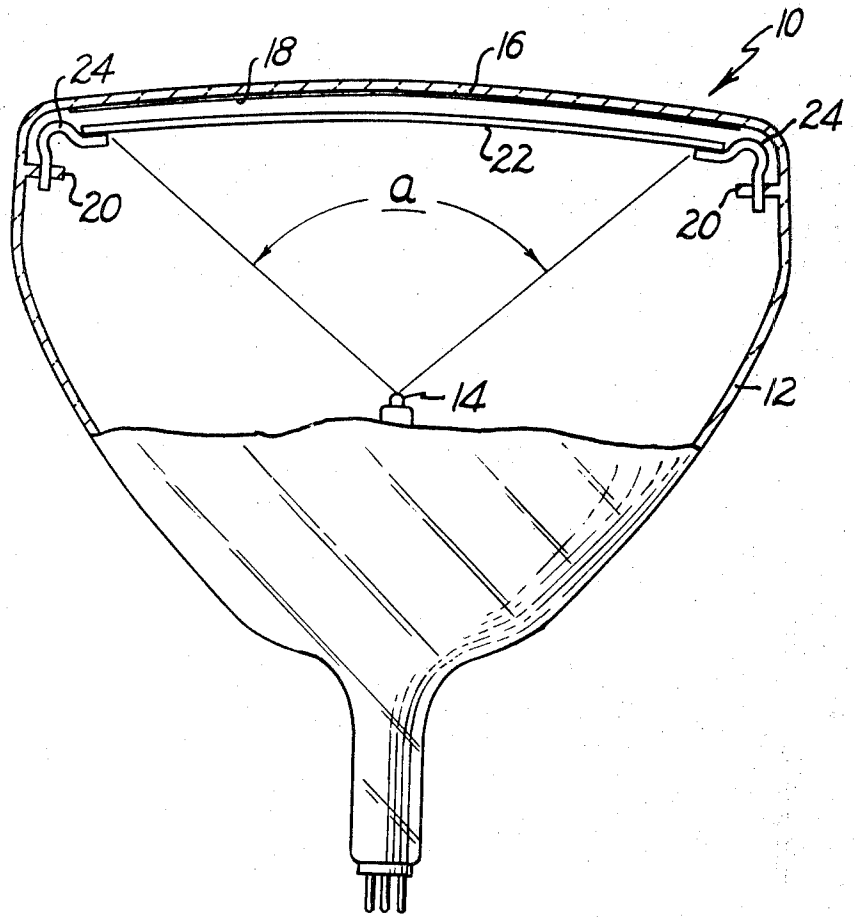


Fig. 1.

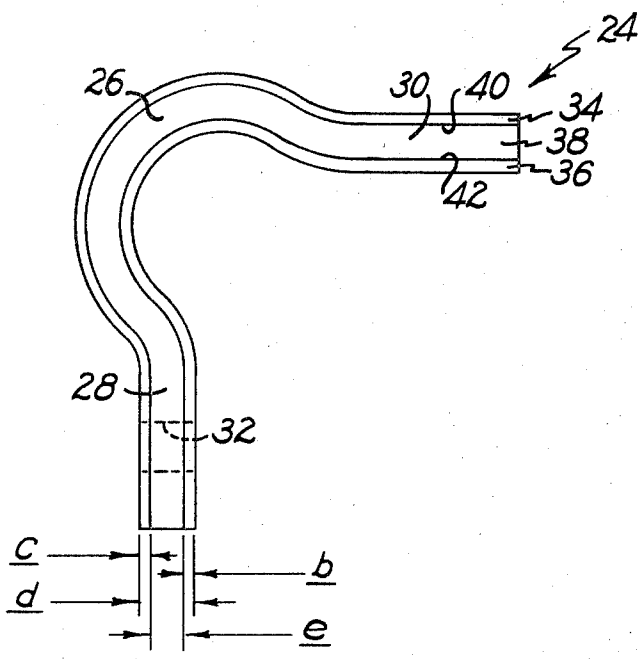


Fig. 2.

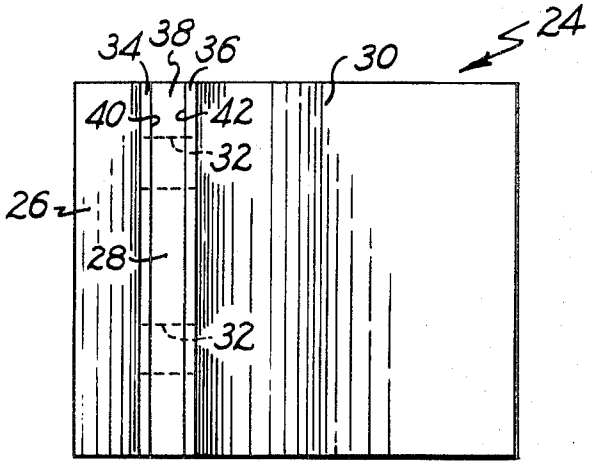


Fig. 3.

COMPOSITE THREE LAYER METAL THERMOSTAT

This a division, of application Ser. No. 278,335, filed Aug. 7, 1972 now U.S. Pat. No. 3,781,583.

In a color television tube wherein electron source means within the tube direct electrons onto phosphors located on the inner surface of the tube face, it is customary to mount a shadow mask having a very large number of very small holes between the electron source means and the tube face so that only electrons following selected paths are permitted to pass through the mask openings to strike respective phosphors. As these shadow masks tend to become heated and tend to expand during tube operation, it has also been customary to mount the shadow mask on the tube envelope by use of thermostat metal support members which move the mask toward the tube face as the mask is heated to compensate for the thermal expansion of the mask to retain proper registration of the mask apertures with respective phosphors on the tube face. Where these thermostat metal members are located inside the tube envelope, it is important that the thermostat metal material be free of any tendency to corrode or to contaminate the tube atmosphere or phosphors during heating thereof; the thermostat metal material must be of relatively high strength at elevated temperatures to support the shadow mask throughout a long tube life; and the thermostat metal material must retain its thermal response characteristics for a long period of time while undergoing repeated heating and cooling. As iron alloy materials have displayed these desirable characteristics for use inside the tube envelopes, it is desirable that the thermostat metals be formed of such iron alloys.

Most recently, with the advent of the slim color television tube having a relatively short space between the tube face and the electron source means within the tube, it is found that only very small shadow mask movement is required or can be permitted for retaining registration of the shadow mask apertures within respective tube face phosphors during thermal expansion of the mask and it is found that the thermostat metal materials customarily used in shadow mask supports have tended to display excessive flexivity making it difficult to proportion shadow mask supports to provide the required compensation for thermal expansion of the mask.

It is an object of this invention to provide a novel and improved support arrangement for the shadow mask in a slim color television tube; to provide such a support arrangement utilizing novel and improved thermostat metal material; to provide such improved thermostat metal material embodying iron alloy material layers which displays high strength and corrosion resistance at relatively high temperatures and which retains its thermal response characteristics throughout a long cycle life; to provide such thermostat metal material which displays low flexivity in temperature ranges from room temperature up to about 350°F.; and to provide such thermostat metal material which is characterized by low cost.

Other objects, advantages and details of the shadow mask support arrangement and thermostat metal of this invention appear in the following detailed description of preferred embodiments of the invention, the detailed description referring to the drawings in which:

FIG. 1 is a plan elevation view of a color television tube partially in section illustrating the shadow mask support arrangement provided by this invention.

FIG. 2 is a plan elevation view to enlarged scale of a thermostat metal support member utilized in the support arrangement of FIG. 1; and

FIG. 3 is a front elevation view of the support member shown in FIG. 2.

Referring to the drawings, **10** in FIG. 1 illustrates a conventional, slim color television tube incorporating the support arrangement for a shadow mask as provided by this invention. As the tube **10** is of conventional structure except for the shadow mask support arrangement, the tube is only partly illustrated in FIG. 1 to show the tube envelope **12,** electron source means **14,** the tube face **16** having color phosphors **18** thereon, bosses **20** integrally formed on the tube envelope, and a shadow mask **22.** As will be understood, the phosphors **18** are arranged in a multiplicity of groups of three colors on the tube face **16** and the shadow mask comprises a sheet of metal such as a sheet of steel foil about 0.005 inches thick having a multiplicity of holes about 400,000 in number (not shown) registered with respective phosphors **18** on the tube face so that only electrons following selected paths from the source means **14** are permitted to pass through the mask apertures to strike respective phosphors **18.** The shadow mask apertures are arranged in a conventional pattern over the effective area of the shadow mask which subtends an angle *a* from the electron source means **14** of about 110° as illustrated in FIG. **1.** In this regard, when a color television tube is hereinafter described as being of slim design, it will be understood that the effective area of the shadow mask of the tube subtends an angle of at least about 110° from the electron source in the tube. As will be understood, the tube **10** is adapted to become heated during operation, this heating resulting in thermal expansion of the shadow mask **22.**

In accordance with this invention, the shadow mask **22** is supported between the electron source means **14** and the tube face **16** by a plurality of support members **24** (only two of which are shown in FIG. **1**) for registering the shadow mask apertures with the respective phosphors **18** on the tube face **16,** these support members **24** each being formed of a three-layer composite thermostat metal. Typically, for example, each of the support members **24** has a curved hinge-like portion **26** and two flange portions **28** and **30** extending therefrom, the flange **28** having two apertures **32** fitted over matching bosses **20** on the tube envelope **12** and the flange **30** being welded or otherwise fixedly secured to the shadow mask **22** in any conventional manner.

In accordance with this invention, each of the thermostat metal support members **24** is formed of a novel and improved thermostat metal material particularly adapted for supporting the shadow mask **22** in a color television tube **10** of slim design. That is, the support members **24** are each formed of a composite metal laminate having one outer layer **34** and another outer layer **36** metallurgically bonded in conventional manner to an intermediate or core layer of metal **38** substantially throughout the interfaces **40** and **42** between the metal layers. More specifically, the metal layer **34** is formed of an iron alloy having a nominal composition by weight of about 22 percent nickel, 3 percent chromium and the balance iron and having a relatively high coefficient of thermal expansion of about 10.5×10^{-6} inches

per inch per degree Fahrenheit; the metal layer **36** is formed of an iron alloy having a nominal composition by weight of about 36 percent nickel and the balance iron and having a relatively low coefficient of thermal expansion of about 0.7×10^{-6} inches per inch per degree Fahrenheit; and the metal layer **38** is formed of a stainless steel material having a nominal composition by weight of 0.05 percent (max.) carbon, 1.00 percent (max.) manganese, 1.00 percent (max.) silicon, 10.00 to 12.00 percent chromium, 0.50 percent titanium, and the balance iron and an intermediate coefficient of thermal expansion of about 6.0×10^{-6} inches per inch per degree Fahrenheit. Alternately, the metal layer **38** is formed of a stainless steel of comparable thermal expansion properties such as an alloy having a nominal composition, by weight, of 0.08 percent (max.) carbon, 1.00 percent (max.) manganese, 1.00 percent (max.) silicon, 0.030 percent (max.) sulfur, 11.50 to 14.50 percent chromium, 0.10 to 0.30 percent aluminum and the balance iron or an alloy having a nominal composition, by weight, of 0.15 percent (max.) carbon, 1.00 percent (max.) manganese, 1.00 percent (max.) silicon, 0.030 percent (max.) sulfur, 11.50 to 13.50 percent chromium, and the balance iron. Most importantly, in the thermostat material of this invention, the metal layers **34** and **36** each have approximately the same thickness comprising from about 17.5 to 27.5 percent of the total thickness of the composite material and the metal layer **38** has a thickness comprising about 45 to 65 percent of the total thickness of the composite thermostat material.

In this arrangement, the thermostat metal material embodied in the support members **24** is entirely formed from iron alloy materials which do not tend to contaminate the atmosphere or the phosphors in the tube **10**; the metal embodied in the support each display substantial strength at the elevated temperatures up to about 350°F. to which they will be subjected in the tube **10**; the metals in the outer layers **34** and **36** of the thermostat metal supports comprise the materials conventionally used in shadow mask supports in color television tubes other than those of slim design and are therefore known and accepted in the market place as being free of contaminating effects and as providing stable thermal response characteristics over a long cycle life; the metal of the layer **38** in the support members **24** is of relatively low cost; and most important, use of the relatively very thick core layer **38** in the thermostat material of this invention provides the thermostat material embodied in the supports **24** with relatively low flexivity (as defined by the American Society for Testing Metals) in the range from 90 to 110 at temperatures up to 350°F. The use of the relatively thick layer **38** of a relatively very inexpensive metal material also significantly reduces the cost of the thermostat metal. Accordingly, the thermostat metal support members **24** are easily proportional for moving the shadow mask **22** toward the tube face **16** as the tube **10** becomes heated during operation, thereby to compensate for the thermal expansion of the mask **22** to retain the mask apertures in registry with the respective phosphors **18** on the tube face during such tube operation in conventional manner.

Preferably, for example, in a preferred embodiment of this invention, each of the supports **24** is formed of thermostat metal material having a thickness of about 0.030 to 0.050 inches wherein the core layer **38** of the thermostat material comprises about 55 percent of the total thickness of the thermostat metal and provides the thermostat metal with the desired combination of properties including a low flexivity of about 100 at temperatures up to about 350°F.

It should be understood that the embodiments of the thermostat metal material and the shadow mask support arrangement which hae been described above have been described by way of illustrating this invention and that this invention includes all modifications and equivalents of the described embodiments falling within the scope of the appended claims.

I claim:

1. A composite three-layer thermostat metal material comprising an outer layer of selected thickness of a metal alloy having a nominal composition by weight of about 22 percent nickel, 3 percent chromium and the balance iron, another outer layer of approximately equal thickness of a metal alloy having a nominal composition by weight of about 36 percent nickel and the balance iron, and an intermediate layer of a metal alloy selected from the group consisting of an alloy having a nominal composition by weight of 0.05 percent (max.) carbon, 1.00 percent (max.) manganese, 1.00 percent (max.) silicon, 10.00 to 12.00 percent chromium, 0.50 percent titanium, and the balance iron, an alloy having a nominal composition by weight of 0.08 percent (max.) carbon, 1.00 percent (max.) manganese, 1.00 percent (max.) silicon, 0.030 percent (max.) sulfur, 11.50 to 14.50 percent chromium, 0.10 to 0.30 percent aluminum and the balance iron, and an alloy having a nominal composition by weight of 0.15 percent (max.) carbon, 1.00 percent (max.) manganese, 1.00 percent (max.) silicon, 0.030 percent (max.) sulfur, 11.50 to 13.50 percent chromium, and the balance iron, said intermediate metal layer being disposed between and metallurgically bonded to said outer metal layers and having a thickness comprising from about 45 to 65 percent of the total thickness of the composite material providing the composite material with a flexivity of about 90 to 110 in the temperature range from room temperature up to about 350°F.

2. A thermostat metal material as set forth in claim **1** wherein said intermediate metal layer has a thickness comprising about 55 percent of the total thickness of the composite material providing the thermostat metal material with a flexivity of about 100 in the temperature range from room temperature up to about 350°F.

* * * * *