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SHADOW MASK AND MAGNETIC SHIELD UNITARY CONSTRUCTION FOR COLOR TV PICTURE TUBES

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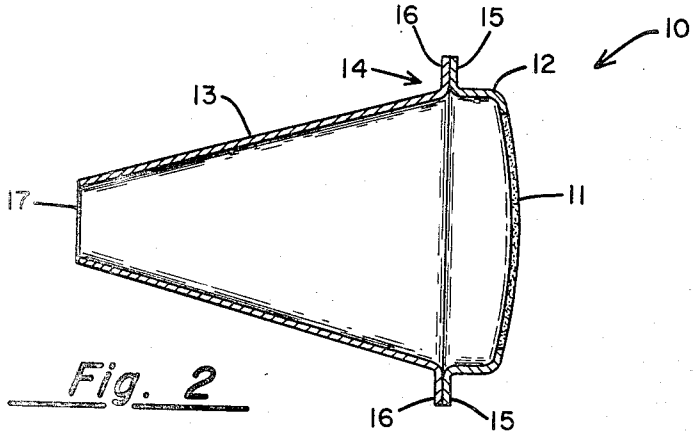


Fig. 2

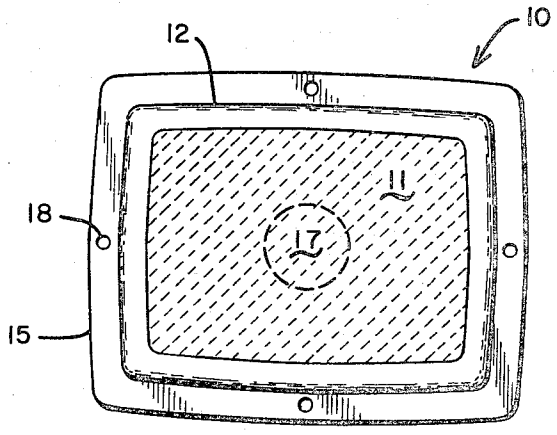


Fig. 1

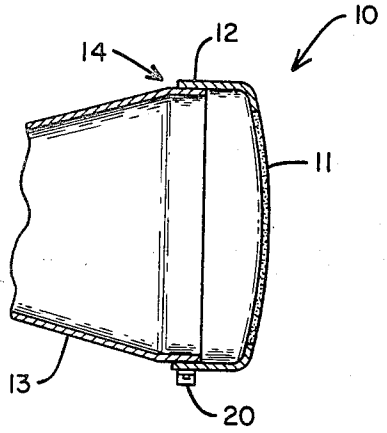


Fig. 3

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SHADOW MASK AND MAGNETIC SHIELD UNITARY CONSTRUCTION FOR COLOR TV PICTURE TUBES

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10 Claims. (Cl. 313—92)

This invention relates generally to color television picture tubes and is more specifically directed toward the shadow mask or aperture mask which is contained in the color television picture tube.

In virtually every present-day color TV picture tube there is a shadow mask or aperture mask which is located between the electron beam source, the electron guns to the rear of the tube, and the front face or viewing screen of the tube. Ordinarily the shadow mask is closer to the face than it is to the guns. The shadow mask is made out of a thin sheet of metal such as .001 to .01 inch stainless steel sheet, and has a translucent area, generally corresponding to the area of the viewing face of the tube, which is surrounded by an opaque band or strip. The translucent area is made up of a myriad of miniature apertures which are formed in a predetermined pattern. Typically, a shadow mask for a 19-inch rectangular tube may contain approximately 350,000 tiny apertures of approximately .01 inch diameter. Briefly, it can be said that the main reason for the aperture mask is to insure that the electron beams from the guns impinge the proper phosphor dots on the picture tube screen to produce the proper color combinations without overlapping onto other dots. By far the most efficient way to produce these shadow masks at mass production rates to meet the demands of the industry has been by photographic and etching techniques in which the pattern of the apertures is initially photoprinted on a sheet of metal and then the holes or apertures are etched out of the metal. After a mask has been made out of a flat sheet of metal it undergoes some further processing steps. Among these are annealing for toughening, blackening to prevent spurious reflections and shaping to conform generally to the contour of the picture tube screen. All of this is ordinarily done before the mask is inserted into the tube to be a part of the picture tube assembly. It is not the main purpose of the present invention to substantially alter or modify any of the foregoing and they have been mentioned here merely for background information.

Ordinarily the flat mask is shaped by putting it through a press which bows or domes out the translucent area and forms the opaque strip around the periphery of the translucent area into a rim. As stated earlier, the primary function of the mask is to assure that the proper phosphor color dot is impinged by the respective electron beams. In conjunction with this, it has been found extremely valuable to use the mask to initially lay out the desired pattern of phosphor dots on the inside face of the picture tube. Briefly, this involves the use of photoprinting techniques which require that the shaped shadow mask be temporarily attached to and removed from the front of the picture tube bulb two or three times before it is permanently attached to become part of the final tube assembly. Without attempting to describe the technique in detail, what this entails is using the shadow mask that is destined for incorporation into the final assembly of the picture tube as a mask to form the desired pattern of phosphor dots on the inside face of the picture tube. Since three primary colors are involved, three different settings of the mask are necessary so that the mask has to be attached and removed three different times. Because of this manner of use of the shadow mask and the final

function it performs in the finished tube assembly, it is essential that the mask be supported in a very stable fashion so that each time it is lifted and remounted when used in the process for forming the phosphor dots, it will return to its same proper setting and when it finally is permanently mounted as part of the picture tube assembly, it will not vary in its setting to any noticeable degree. Although doming the translucent area and bending the opaque area in forming a rim does strengthen the mask and provide some degree of stability, nevertheless the mask is usually still too flexible and too susceptible to shift its position to be used without further strengthening. Heretofore, stability has been achieved by providing a heavy metal mounting ring around the rim of the shadow mask. The rim of the mask is attached to the mounting ring in some convenient fashion and the ring, in turn, is mounted to a flange which is attached to the picture tube bulb. The ring ordinarily carries various locating means such as springs for accurately locating the ring-mask assembly before attaching it to the flange. The use of the mounting ring not only requires costly and time-consuming operational steps to assemble the mask and to attach it to the tube bulb, but it also adds substantial weight which serves no other purpose than to keep the mask rigid and substantially inflexible.

It is the general object of this invention to provide stable shadow masks for color TV picture tubes without many of the disadvantages encountered heretofore.

It is a more specific object of this invention to provide a stable shadow mask which can be mounted as part of the picture tube assembly in a variety of fashions.

Still a further object of this invention is to construct the shadow mask in such a fashion that it can be handled easily when using it in the process for initially forming the phosphor dots on the picture tube screen.

Yet another object of this invention is to make the shadow mask and the interior magnetic shield, which is usually found in the picture tube assembly, as a compact unit assembly so that each enhances the function and operation of the other.

These and other objects and features of this invention will become apparent during the course of the following detailed description with reference to the accompanying drawings in which:

FIGURE 1 is a front face view of an embodiment of the invention showing the shadow mask with a flared rim;

FIG. 2 is a sectioned side view of an embodiment of the invention, illustrating one manner of attaching the shield to the shadow mask;

FIG. 3 is a sectioned partial side view of another embodiment of the invention illustrating a different manner of attaching the shield to the mask.

The shadow mask **10**, which is sometimes referred to as an aperture mask, consists of a translucent area **11** which is formed by a multiple of very tiny apertures, and an opaque rim area **12** which surrounds the translucent area **11**. In general, the translucent area corresponds in size to the screen of the picture tube which is on the front face of the tube, not shown.

FIGS. 2 and 3 best illustrate the manner in which the translucent area **11** of mask **10** is bowed out or domed to generally form a curved section which conforms generally to the contour of the inside face of the picture tube. It can be seen that the rim **12** around the periphery of the translucent area **11** is bent at approximately a 90° angle to what would be a projection of the curved section in a plane. In the case of a circular viewing screen, the mask is domed to form a section of a sphere. In the past the practice has been to attach a heavy mounting ring to this rim area to provide the reinforcing structure in order to make the mask quite stable.

Without this reinforcement, although the rim provides some stiffening support as does the doming of the translucent area, it can be visualized that because the mask is made of very thin material and is further weakened by the holes in the translucent area, it is quite flexible and would not reliably repeat its setting each time it was moved. Any degree of handling and temperature differentials normally encountered inside the tube would likely distort the mask so that it would not realign correctly.

Extending rearwardly from the back of the mask **10** is a funnel-shaped interior magnetic shield **13** which tapers smaller toward the rear where the electron guns are located. At its most frontward end, which we will call the base **14**, the shield **13** is fixedly attached to the rim **12** of the mask **10** by spot welding or the like. In the embodiment shown in FIG. 2 this is done by forming a flare **15** on rim **12** of the mask and a corresponding flare **16** around the base of the shield **13** and then laying the two flared portions over one another and welding them together over the periphery. This forms a unitized assembly with the shield **13** providing the required additional stabilizing strength for the mask **10** and the mask, in turn, helping to form a more closed magnetic shielding section. The shield **13** is preferably made out of cold rolled steel ranging from .003 to .006 inch thickness, although no limitation thereto is intended. The smaller opening **17** at the rear of the shield **13** is in the vicinity of the electron guns and is suitable to accommodate the electron beams which travel from the guns through the mask **10** to the screen. The opening **17** is also of sufficient size to accommodate any equipment or the like which is used in the process of forming the phosphor dots on the picture tube screen while using the mask **10**, as mentioned earlier. It has been found that the shield-mask combination constructed in the described manner provides sufficient rigidity for the mask and since the heavy supporting ring is no longer required, the over-all weight of the picture tube assembly is reduced a substantial amount.

Although it is contemplated that the shield-mask assembly can be joined to the tube bulb in a variety of manners to become part of the picture tube assembly, one embodiment entails forming locating holes **18** at suitable predetermined positions around the flared portion of the shield-mask assembly and mating these holes with suitable locating pins or the like (not shown) which are formed in suitable fashion on the edge of the front portion of the picture tube bulb.

In another contemplated embodiment of the invention such as shown in FIG. 3, neither the front edge or base of the shield **13** nor the rim **12** of the mask **10** would be flared. The base of the shield **13** is slipped just inside the rim **12** and the two are welded together around the entire periphery forming a double thickness over a narrow strip of metal. Attached to the outside of this double layer by welding or by some other suitable fashion are locating and mounting springs **20** which are used to index and mount the unitized shield-mask assembly to the glass bulb. This later embodiment is adaptable for use with present-day mounting and locating hardware. It can be seen that in both described embodiments, to lift the mask off its mountings to the glass bulb, one merely has to grasp the shield portion so that no pressure or force is brought to bear on the mask to disturb its setting. Furthermore, this improved construction provides greater and more uniform heat dissipation inside the closed picture tube assembly thereby further minimizing the likelihood of any shifting of the mask position due to temperature change.

I claim:

1. For a color TV picture tube, in combination: a thin metallic shadow mask containing a myriad of miniature apertures through which electron beams travel from electron guns at the rear of the picture tube to the screen at the face of the picture tube; said mask being shaped to conform generally to the inside of the picture tube bulb for allowing the electron beams to strike appropriate spots on the face in proper focus; and a funnel-shaped metallic shield extending rearward from said mask, the base of the shield being rigidly attached to the periphery of said shadow mask for strengthening the mask to make it substantially inflexible.

2. The invention as described in claim **1** wherein said shield is shaped to conform generally to the inside of the conical portion of the picture tube bulb with the smaller opening being at least large enough to accommodate the electron beams travelling from the electron guns to the shadow mask.

3. The invention as described in claim **1** wherein the shadow mask comprises: a thin metallic sheet having a translucent area containing a myriad of miniature apertures corresponding substantially to the area of the viewing face of the picture tube and domed to conform generally to the contour of the inner face of the tube; and an opaque strip around the periphery of the translucent area shaped to form a supporting stiffened rim for said translucent area.

4. The invention as described in claim **3** wherein the base of said shield generally follows the periphery of the mask translucent area and is rigidly attached to said rim.

5. The invention as described in claim **4** further including, locating means attached to the outside of said rim for mounting the mask to the picture tube bulb.

6. The invention as described in claim **5** wherein said locating means comprises a plurality of holes in said rim adapted for mating with corresponding locating pins in the picture tube bulb.

7. The invention as described in claim **3** wherein said translucent area is domed to form a curved section and said rim forms substantially a 90° angle to the corresponding planar projection around the periphery of the translucent area and the other edge of said rim flares outward to substantially a 90° angle.

8. The invention as described in claim **7** wherein the base of the funnel-shaped shield has an outward flaring rim which is fixedly joined to the flared-out portion of the shadow mask rim.

9. The invention as described in claim **8** wherein the joined flared sections contain locating holes adapted for mating with locating pins in the picture tube bulb.

10. The invention as described in claim **5** wherein: said translucent area forms a curved section with the mask rim being at substantially 90° to a planar projection of said curved section; and the base of said shield rests inside said rim and is fixedly attached thereto to form an encircling double thickness metal band.

No references cited.

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