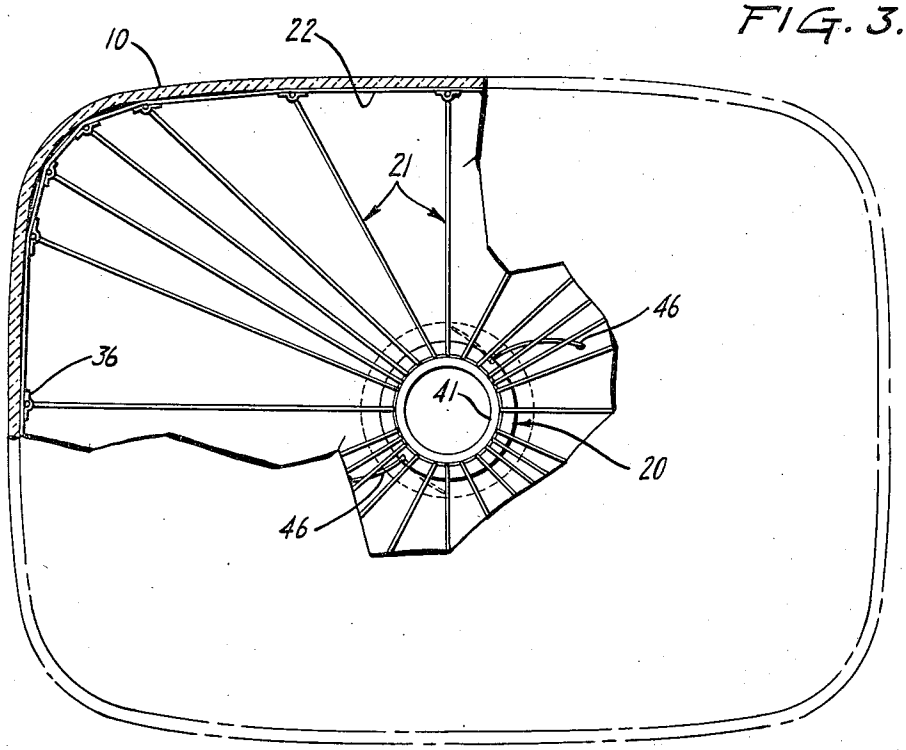
April 22, 1958 M. SADOWSKY ET AL 2,831,455

MASKING MEANS

Filed Aug. 4, 1955 3 Sheets-Sheet 1

FIG. 3.



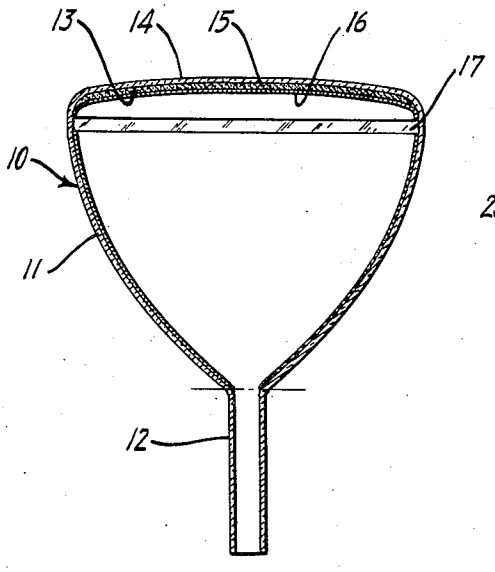


FIG. 1.

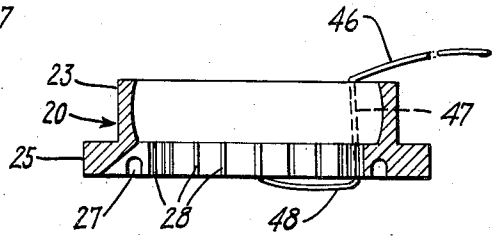


FIG. 6.

INVENTORS
MEIER SADOWSKY
ELMER O. THOMPSON

BY
Carl H. Synnestvedt
AGENT

April 22, 1958 M. SADOWSKY ET AL 2,831,455

MASKING MEANS

Filed Aug. 4, 1955 3 Sheets-Sheet 2

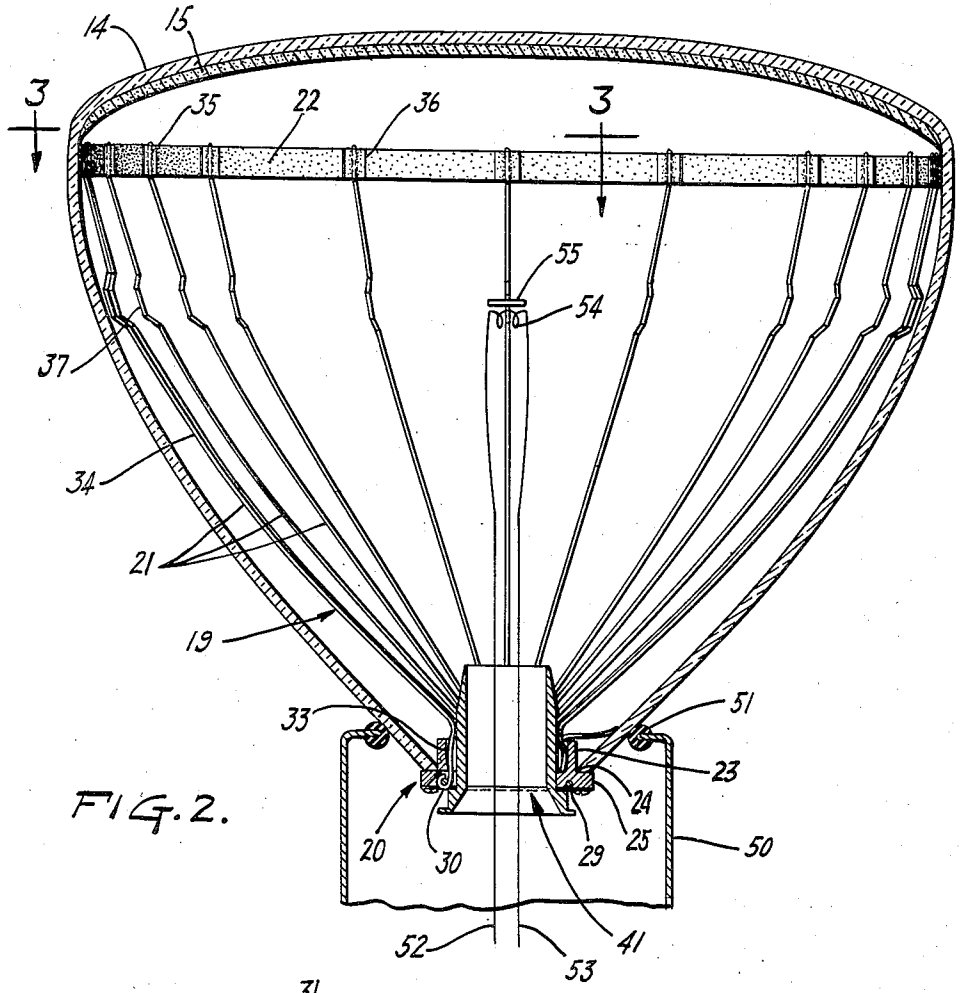


FIG. 2.

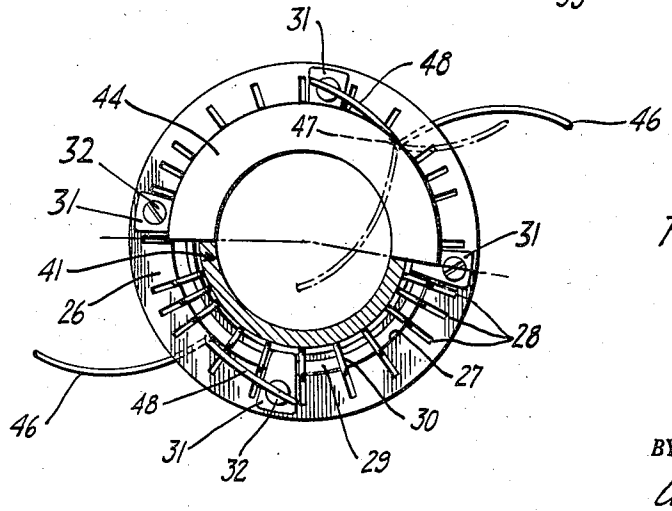


FIG. 5.

INVENTORS
MEIER SADOWSKY
ELMER O. THOMPSON

BY

Carl H. Synnestvedt

AGENT

April 22, 1958 M. SADOWSKY ET AL 2,831,455

MASKING MEANS

Filed Aug. 4, 1955 3 Sheets-Sheet 3

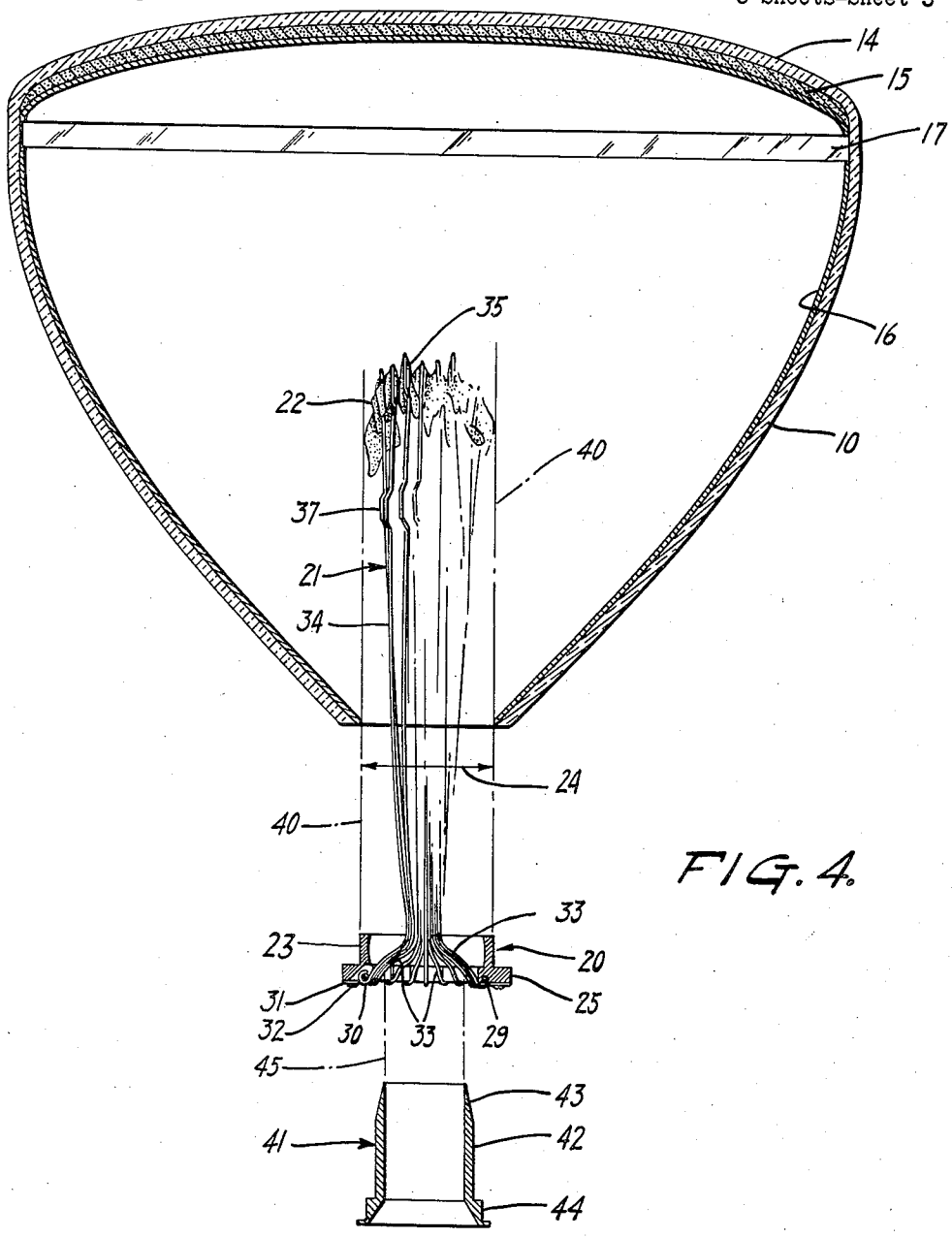


FIG. 4.

INVENTORS
MEIER SADOWSKY
ELMER O. THOMPSON

BY

Carl H. Synnestvedt

AGENT

United States Patent Office 2,831,455 Patented Apr. 22, 1958

2,831,455

MASKING MEANS

Meier Sadowsky, Elkins Park, Pa., and Elmer O. Thompson, Grasmere, N. Y., assignors to Philco Corporation, Philadelphia, Pa., a corporation of Pennsylvania

Application August 4, 1955, Serial No. 526,369

5 Claims. (Cl. 118—505)

The invention thereinafter described and claimed relates to apparatus for use in providing coatings on localized areas of the interior walls of hollow articles, such as the glass envelopes of cathode ray tubes.

In certain types of cathode ray tubes, using an electron beam for producing luminescence in a phosphor screen, it is the practice to coat interior wall portions of the tube with a thin electron-pervious metal film. The film is formed by evaporating a small quantity of metal, preferably aluminum, within the bulb of the tube envelope while holding a vacuum in the latter.

During forming of such films, and particularly in cathode ray tubes used for color television, it is very difficult to limit deposition of the film to desired areas, and the film becomes so tightly bonded to the glass surface of the tube envelope that it is difficult to remove it from areas where it is not desired.

While it is the broad object of the present invention to provide means whereby a metallic film may be deposited on predetermined areas only of the interior walls of hollow articles, more specifically the invention has for its object the provision of apparatus for preventing the metal film from being deposited upon areas of the envelope of cathode ray tubes where such a film is undesirable.

In accordance with the invention, and first briefly described, the apparatus comprises an umbrella-like rib device movable between collapsed and extended conditions, and utilized in combination with flexible and resilient strip-like masking means carried by the free ends of the ribs. The rib structure, when collapsed or folded, is readily insertable within the narrow opening of the tube bulb, after which extension of the ribs stretches the resilient mask which is moved toward and brought into intimate confronting relation with respect to predetermined areas to be masked, thereby preventing deposition of the metallic film upon these areas.

It is a feature of the invention that the resilience of the masking element insures proper positioning of the mask with respect to the wall areas to be covered, regardless of variations in the internal dimensions of successive tubes being processed.

The foregoing objects, advantages, and features of the invention will be fully understood from a consideration of the following description taken together with the accompanying drawings, in which:

Figure 1 is a sectional view of a typical cathode ray ray tube after the metal film has been deposited upon its interior walls;

Figure 2 is an enlarged sectional view of a cathode ray tube bulb showing the masking apparatus of the invention in operative position within the bulb;

Figure 3 is a fragmentary sectional view of a tube bulb taken substantially along line 3—3 of Figure 2;

Figure 4 is a view similar to Figure 2 but showing the masking device in its collapsed or folded condition as it is inserted within or withdrawn from the tube bulb;

Figure 5 is a bottom plan view, partly in section, of a portion of the masking device; and

Figure 6 is an enlarged sectional view of an element of the apparatus.

More specifically, and with initial reference to Figure 1 illustrating a typical cathode ray tube, the numeral 10 designates the tube envelope formed of glass, quartz, or similar material, and comprising a bulb portion 11 and a narrow neck portion 12. The inner surface 13 of the bulb face 14 has a fluorescent phosphor screen 15 coated with a thin electron-pervious reflective metal film 16.

In accordance with well known practice, the metal film 16 is formed by evaporating a small quantity of metal, usually aluminum, within the envelope bulb while maintaining a vacuum in the latter. The aluminum vapor condenses upon and adheres tightly to the inner surface of the screen and to all the exposed surfaces of the tube walls. Because of electrical circuit requirements, however, it is undesirable to have the film on certain areas of the walls, for example, the area 17 adjacent screen 15. The present invention provides novel masking means to prevent the film from being deposited upon these areas.

While Figure 1 shows in cross section a complete cathode ray tube envelope, including the bulb and neck portions 11 and 12, respectively, it will be understood that, for convenience in practicing the invention, only the bulb portion is present during processing of the tube, the neck being attached later.

As seen in Figures 2 and 3, the masking apparatus, designated by the numeral 19, comprises, generally, a base 20, a plurality of flexible stays or ribs 21 pivotally mounted on the base, and a resilient masking element 22 carried by the ribs.

Base portion 20 comprises a tubular collar 23 (Figure 6) the outer diameter of which is substantially the same as the diameter of the bulb opening or throat 24, but sufficiently smaller to permit insertion of the collar snugly within the opening. The bottom edge of the collar terminates in a flange portion 25 formed integrally therewith. The bottom surface 26 of the flange is provided with an annular groove 27 (see Figures 5 and 6) intersecting a plurality of radial slots 28 extending angularly upwardly and inwardly from bottom surface 26 to the intersection of the inner wall of the collar with the top surface of the flange.

Each of the ribs 22 is pivotally attached at its lower end to a ring 29 by an end portion 30 looped around the ring. In assembling the ribs to base 20, ring 29 is inserted in the annular groove 27 with loops 30 in slots 28, the latter being so arranged as to space the ribs in the most advantageous positions around the walls of the bulb. In the illustrated embodiment, four ribs are disposed for positioning in each corner of the bulb, with other ribs spaced along the tube sides; as shown, the apparatus utilizes twenty-four ribs. Ring 29 is retained in groove 27 by tabs 31 secured to the underside of base flange 25 by screws 32, as seen in Figure 5.

Each rib comprises the above-mentioned looped end portion 30, a short outwardly curved portion 33 extending tangentially from the looped portion, a long slightly curved portion 34 bent outwardly from portion 33, and a short end portion 35 bent inwardly at a slight angle from portion 34. The masking element 22 is secured to the ends of the ribs by tabs 36, preferably made of the same material. As shown at 37, intermediate the ends of the ribs, an offset portion is provided for carrying an additional masking element, if desired, or for adjusting the lengths of the ribs—by bending or straightening—to meet various conditions in differently designed tube bulbs.

As indicated above, the masking element 22 comprises a band of thin flexible resilient material, and, while other materials are suitable, it is preferred to use a material manufactured under the trade name "Silastic R-tape," and comprising a fibre-glass tape impregnated with a silicon

rubber composition. An important consideration of the material selected is that no undesirable residue be left within the tube after the coating is formed, and the mentioned material has proven very satisfactory in this respect.

Now with reference to Figures 2, 3 and 4, the operation of the apparatus will be described. As seen in the latter figure, the umbrella-like masking device is shown partially in phantom, for clarity of illustration, in its collapsed condition with the ribs in a substantially vertical position. It will be noted—looking at reference lines **40**—that in this collapsed condition the masking apparatus may readily be moved, either inwardly or outwardly, through the throat opening **24** of the bulb. When fully inserted, as seen in Figure 2, the throat snugly surrounds collar **23** and is seated on the top of flange **25** thus holding the tube and masking apparatus in proper registry. To move ribs **22** to their extended open condition, as seen in Figures 2 and 3, a hollow plug **41** is provided. The plug—see Figure 4—comprises a cylinder or sleeve **42** having its upper periphery tapered, as at **43**, to facilitate spreading of the ribs when the plug is inserted in the collar. The lower periphery of the plug is provided with a flange **44** which stops the plug at its proper position in base **20**, as shown in Figure 2.

When the masking device has been fully inserted within the tube, as described above, plug **41** is forced into sleeve **23** against rib portions **33**, as indicated by reference lines **45** in Figure 4, spreading the ribs radially to the positions shown in Figures 2 and 3. In arriving at these positions, outer ends of tips **35** of the ribs bear against the inner walls of the tube, after which further movement of the plug to its fully inserted position, as seen in Figure 2, flexes the ribs to introduce slight curvature and presses rib end portions **35** tightly against the inner walls and into a position substantially parallel therewith. When in this position, masking element **22**, due to its resilience, is stretched between the ends **35** of the ribs, bridging the space between the ends of adjacent ribs in a straight line, leaving only an extremely small space between the wall and the mask. The number of ribs provided is sufficient to make this space an inconsequential minimum. In actual practice it has been found that a space up to one-eighth of an inch is not detrimental to efficient use of this apparatus.

It is to be appreciated that since the masking element is made of elastic material, any departure from rigid tolerances, in the internal dimensions of tubes being processed, is automatically compensated for and adequate masking is insured.

To prevent accidental displacement of the assembly relative to the tube bulb, base **21** is provided with a pair of resilient finger elements **46** pivotally mounted thereon, as by portions **47** which extend through apertures in the base. The lower end **48**, of each finger element, is bent substantially at right angles to portion **47** and radially about 90° from the finger portion, providing actuating means for rotating the finger portions against the inner walls of the bulb. During insertion of the masking device into the bulb, the fingers are retracted, as seen in broken lines in Figure 5, but after the masking device is fully within the bulb, the elements are rotated to the positions clearly shown in Figure 3, wherein the ends of the fingers **46** are resiliently urged against the inner walls of the bulb. When the plug is in the collar, curved portion **33** of the ribs are exerting sufficient pressure against the plug to keep it from falling out of the collar.

In actual use of the device, and as seen in Figure 2, the bulb and mask assembly is placed on a tubular support element **50** provided with a sealing gasket **51**. The bulb is now ready for application of the aluminum coating. Normally this is performed by heating and evacuating the bulb and then vaporizing a suitable metallic light reflecting material, such as aluminum, within the bulb to cause deposition of the coating on the exposed inner walls thereof. For this purpose, any suitable vaporizing and bulb evacuating apparatus may be employed. For example the supporting element **50** may be connected to a suitable suction pump, and the aluminum vaporizing apparatus may comprise a pair of lead-in wires **52** and **53** extending through hollow plug **41**. At their inner ends the lead-in wires are connected to a suitable filament **54**, of tungsten for example, over which is supported a small loop or bar **55** fabricated of aluminum or other metal to be vaporized. The bulb is then evacuated through tube **50** and plug **41**, and the filament is heated by the application of an electric current across the lead-in wires thus to cause vaporization of the aluminum bar. The metal vapor condenses quickly upon the exposed portions of the inner surface of the bulb to form the desired reflective coating.

After the bulb has been provided with a metallic coating, the masking apparatus is withdrawn from the bulb by removing plug **41**, collapsing the ribs to the condition shown in Figure 4, and then withdrawing the assembly from the bulb.

Collapsing of the ribs may be accomplished by rotating fingers **46** inwardly against the ribs, or by first retracting the fingers and then withdrawing the masking apparatus, letting the tube walls surrounding the throat opening **24** force the ribs inwardly until they are sufficiently withdrawn to be grasped by the hand and moved to the fully collapsed condition, as seen in Figure 4.

During the aluminizing process, it will be understood that condensing deposition of the coating upon the walls is substantially directional, the metallic vapor radiating from the position where the bar of metal is evaporated. Therefore the slight spacing of masking element **22** from the walls of the tube, as between the ends of ribs **35**, see Figure 3, is inconsequential. This is particularly true when the point of vaporization lies in or near the plane defined by the masking element.

From the foregoing description, it will now be seen that the invention described above provides novel and improved apparatus for masking predetermined areas of the interior walls of narrow-neck hollow articles, such as the glass envelopes of cathode ray tubes.

We claim:

1. A masking device for the interior walls of a narrow throat cathode ray tube bulb, comprising: a tubular base member; a plurality of flexible ribs having end portions pivotally mounted upon and extending through the bore of said base member, said ribs being movable between a folded position in which they substantially parallel the axis of said base member and an expanded position in which they extend generally radially from said base member; masking means comprising a continuous thin ribbon of flexible and resilient material secured to the outer free end portions of said ribs; and means insertable within the bore of said base member and adapted to contact the pivotally mounted end portions of the ribs disposed thereon to urge said ribs from said folded to said expanded positions, whereby said masking means is moved into close adjacency to the interior wall portions of said tube bulb.

2. A masking device for the interior walls of a narrow neck enclosure, comprising: a generally tubular base member; a plurality of rib-like elements pivotally mounted toward one end of said tubular base member and extending through the bore of the latter, said rib-like elements being movable upon said base member between a folded position, substantially paralleling one another, and an expanded position in which said elements extend generally radially from said base member; extended flexible and resilient masking means secured to adjacent free end portions of said rib-like elements; and means insertable within the bore of said tubular base member and adapted to bear against said rib-like elements as they extend through the bore of said member, whereby to move said elements to said expanded position.

3. A masking device for the interior walls of a narrow throat cathode ray tube bulb, comprising: a tubular base member having an annular groove portion and a plurality of slotted sections intersecting said groove portion and extending generally radially of said base member; a plurality of flexible ribs having inner end portions pivotally mounted within said groove portion and each rib extending through a corresponding one of said slotted sections and thence through the bore of said tubular base member, said ribs being movable between a folded position in which they substantially parallel the axis of said base member and an expanded position in which they extend generally radially of said base member; masking means comprising a flexible and resilient ribbon-like element secured to and suspended between outer free end portions of said ribs; and means insertable within said base member and effective to slidably engage and move said ribs from said folded to said expanded positions, whereby said flexible and resilient ribbon-like masking element is moved into close adjacency with interior wall portions of said tube bulb.

4. A masking device for the interior walls of a narrow throat cathode ray tube bulb comprising: a tubular base member insertable in the throat of said tube bulb and adapted to be nested therein; a plurality of flexible ribs having substantially straight free end portions and opposite arcuate end portions, the latter portions being pivotally mounted upon and extending through the bore of said base member, said ribs being movable between a folded position in which said arcuate portions are disposed in close proximity within said base member and the said free end portions extend substantially in the direction of the axis of said tubular base member, and an expanded position in which said free end portions diverge from the axis of said base member; masking means comprising a flexible and resilient ribbon-like element secured to and suspended between the free end portions

of said ribs; and means insertable within said base member and adapted slidably to engage said arcuate portions, said last means being effective to urge said arcuate portions radially of said base member to move said free end portions from said folded to said expanded position, whereby said flexible and resilient ribbon-like masking element is moved into close adjacency with interior wall portions of said tube bulb.

5. A masking device for interior wall portions of a narrow throat bulb, comprising: support means; a plurality of flexible ribs having end portions mounted upon said support means, said ribs being movable between a folded position in which they are disposed in adjacency and an expanded position in which they diverge outwardly from said support means with their outer free ends spaced substantially from one another; and means carried by said outer free ends of said ribs and adapted, when said ribs are inserted within a bulb and moved to their expanded position, to be stretched between the spaced outer free ends of said ribs and to closely overlie and conform to an annular strip-like area of the interior wall surface of said bulb, said last means comprising a flexible and resilient tape extending between and secured to said outer free ends of said ribs.

References Cited in the file of this patent

UNITED STATES PATENTS

1,141,494	Schultz et al.	June 1, 1915
1,273,861	Howard	July 30, 1918
1,297,469	Howard	Mar. 18, 1919
1,429,828	Baker	Sept. 19, 1922
1,593,494	Henry	July 20, 1926
2,160,714	Biggs	May 30, 1939
2,657,150	Hermanson	Oct. 27, 1953
2,695,593	Sollami	Nov. 30, 1954
2,731,947	Harder et al.	Jan. 24, 1956