# United States Patent [19]

**Dapolito et al.**

[11] **3,873,365**

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[54] **APPARATUS FOR CLEANING SEAL EDGE REGIONS OF CATHODE RAY TUBE PANELS**


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[52] **U.S. Cl.** ..... **134/140,** 117/8.5, 118/56, 134/23, 134/32, 134/152, 134/201

[51] **Int. Cl.** ..... **B08b 3/08**

[58] **Field of Search** ..... 134/32, 23, 26, 39, 137, 134/152, 166 R, 201, 140; 117/8, 33.5 C, 33.5 CM, 102 R, 8.5; 118/56



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 970,872 | 9/1910 | Babock | 134/137 |
| 2,763,276 | 9/1956 | Irwin | 134/137 |
| 2,827,390 | 3/1958 | Garrigus | 117/8.5 |
| 2,992,107 | 7/1961 | Kaplan et al. | 117/33.5 C |
| 3,326,224 | 6/1967 | Gartner | 134/152 X |
| 3,376,153 | 4/1968 | Fiore | 117/102 R X |
| 3,746,020 | 7/1973 | Pekosh | 134/166 R X |
| 3,759,735 | 9/1973 | Pekosh | 117/33.5 C |



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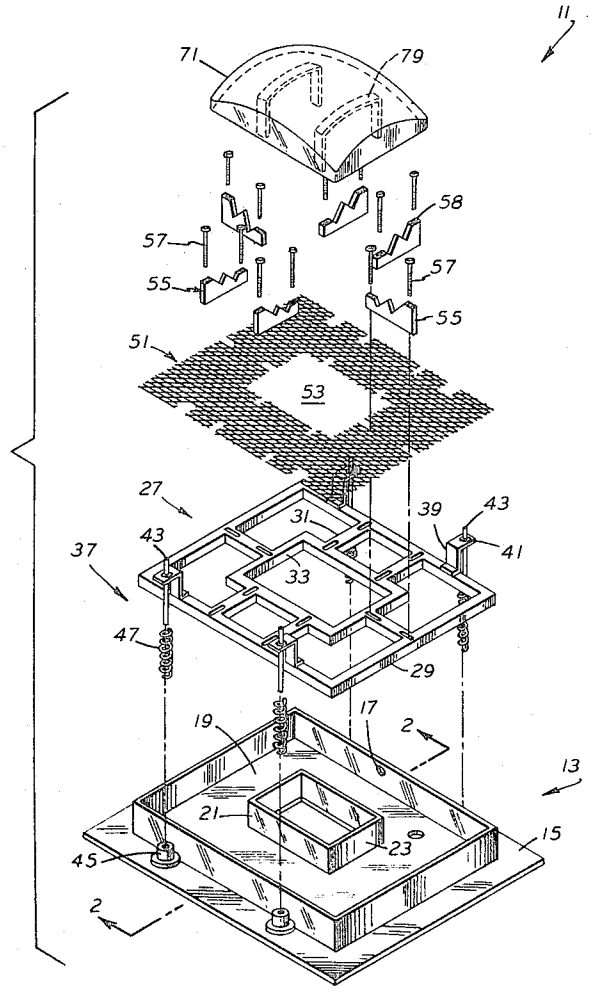
[57] **ABSTRACT**

An apparatus is provided for cleaning extraneous coating material from the seal edge region of a cathode ray tube face panel. The coated panel is horizontally positioned with the sidewall edge thereof oriented in a downward direction over a container of solvent. A shielding member is spatially positioned to protect the viewing area of the panel from subsequent spurious splashings of the solvent. The surface of the solvent is contacted with mesh-like member to break the surface tension thereof in a turbulent-free manner, whereupon, the seal edge is immediately immersed in the solvent to loosen the extraneous edge-oriented coating. The interior of the inverted panel is vented to facilitate the rise of the solvent to the desired level of the interior of the panel sidewall. The panel edge is thence removed and rinsed to remove the loosened coating from the edge region.


**6 Claims, 8 Drawing Figures**



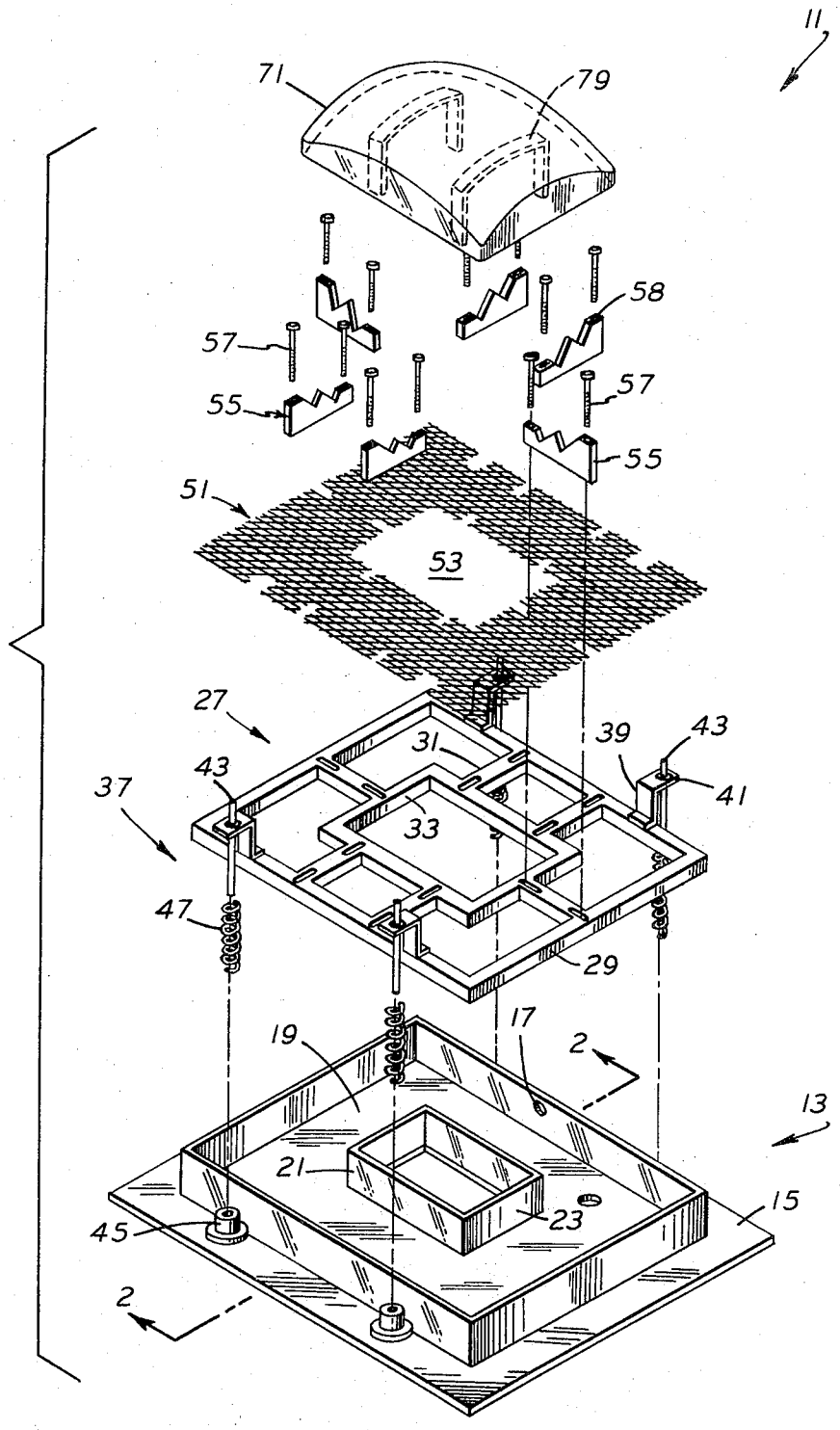

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Fig. 1

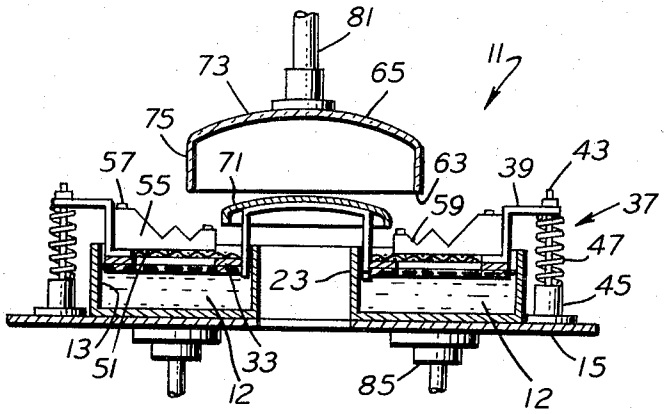


Fig. 2a

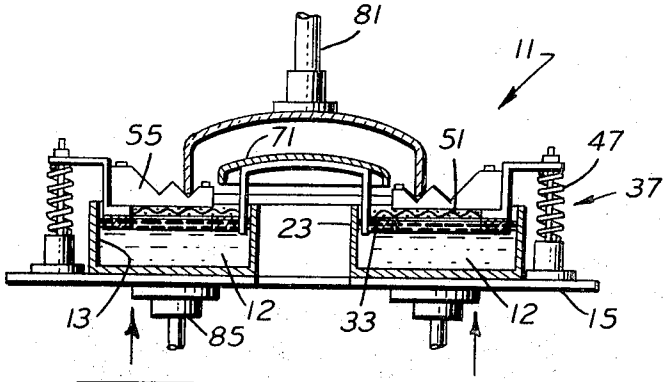


Fig. 2b

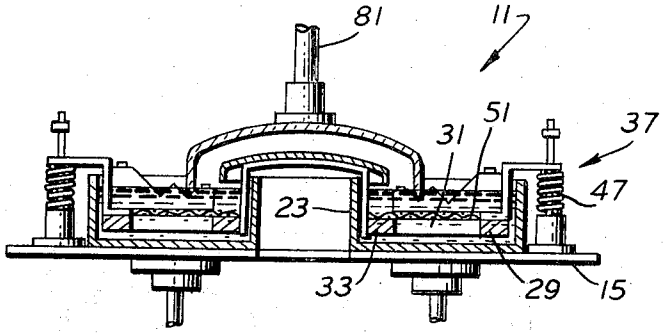


Fig. 2c

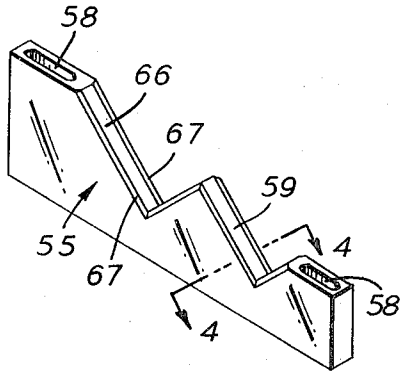


Fig. 3

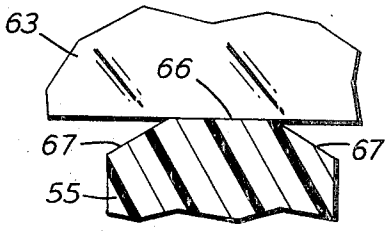


Fig. 4

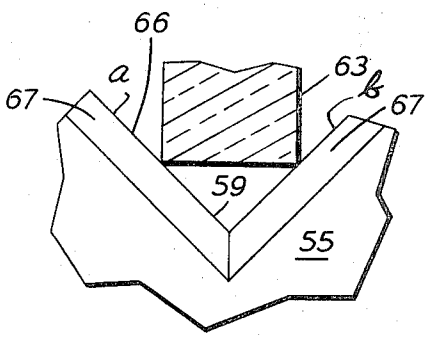


Fig. 5

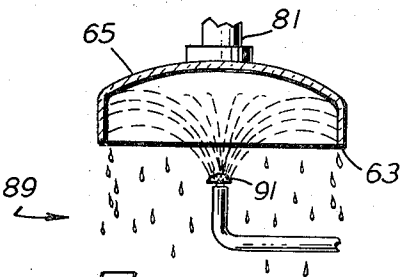


Fig. 6

# APPARATUS FOR CLEANING SEAL EDGE REGIONS OF CATHODE RAY TUBE PANELS

## BACKGROUND OF THE INVENTION

This invention relates to color cathode ray tubes and more particularly to an apparatus for cleaning the edge region of tube face panels during tube manufacturing.

Color cathode ray tubes, such as those employed in television applications often have patterned multiplex screen structures comprising reflective groups of related phosphor elements whereof the interstitial spacing between adjacent pattern elements is covered by an opaque light-absorbing material. Specifically, to improve contrast each phosphor element is defined by an opaque encompassment, of for example graphite, which collectively comprise a foraminous pattern in the form of a windowed webbing having an array of substantially opaque-connected interstices. While such web-like structures have been fabricated either before or after screening of the phosphor elements, it has been found most expeditious to form the opaque window-defining-webbing on the panel before deposition of the phosphors. By one screen forming procedure, a pattern of clear polymerized polyvinyl alcohol pattern elements is light disposed on the panel on those areas subsequently to be windows in the opaque webbing, by photo exposure through a related apertured mask member. After development, the resultant island-like polymerized pattern elements are surrounded by bare interstitial areas of glass. The opaque graphite coating is then applied to completely overcoat the interior of the panel covering the clear pattern elements and the adjacent bare interstitial glass areas. Next, an oxidizing agent is applied to completely degrade the polymerized window pattern elements thereby loosening the superjacent opaque coating thereon, whereupon the materials so loosened are removed by a subsequent water development step. Thus, there is formed an opaque interstitial web of graphite material having multitudinous windows defined as bare glass areas of a size related to the apertures in the pattern mask members. Since the graphite has been previously disposed over the whole of the interior of the panel, it is also residual in the sealing edge region of the panel sidewall. It is essential that this extraneous graphite material be removed from the region of the panel sealing edge to facilitate subsequent hermetic bonding of the panel to the funnel portion of the envelope assembly. Usually, the removal of the graphite from the seal edge region is accomplished either before the oxidizing agent is applied to degrade the polymerized window pattern or immediately following the ensuing development step. Regardless of when this necessitous cleaning operation is performed, it is both a painstaking and time-consuming process. One procedure commonly used is to hand wipe the seal edge with sponges and an abrasive rubber block. A disadvantage of this hand operation is evidenced when the sponges and blocks become increasingly contaminated with graphite after the treatment of several panels, a condition which hinders efficient cleaning of the panel. In addition, any deviation in the hand cleaning procedures causes synchronization difficulties with other facets of the related machine-paced tube manufacturing operation.

## OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the invention to reduce the aforementioned disadvantages by providing an efficient apparatus for cleaning the sealing edge region of cathode ray tube panels. Another object is to provide a panel cleaning apparatus that is capable of synchronization into the machine-paced tube manufacturing operation.

These and other objects and advantages are achieved in one aspect of the invention by the provision of an apparatus for cleaning extraneous coating from the seal edge region of a CRT face panel. The coated panel is located in a horizontal position with the sidewall edge oriented in a downward direction over a container of liquid solvent solution. A shielding member contoured of a shape similar to that of the panel is positioned to protect the coating disposed on the viewing area, and sidewall portion contiguous thereto, from subsequent possible spurious splashings of the related solvent. The shielding member is spatially related to both the panel and the solvent. The surface of the solvent is contacted with means for breaking the surface tension thereof in a turbulent-free manner; whereupon, the sealing edge of the panel is immediately immersed into the solvent to loosen the bonding of the coating material contacted. The interior of the panel is vented to atmospheric pressure to facilitate the rise of the solvent to the desired level on the interior coated surface of the panel sidewall. The panel edge region is thence removed from the solvent, the withdrawal being consummated in a manner to minimize turbulence of the solvent. The panel is thence rinsed to remove the loosened coating from the edge region.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded isometric view illustrating constructional details of the cleaning apparatus;

FIGS. 2*a*, 2*b*, and 2*c* are sectional views of the assembled apparatus taken substantially along the line 2—2 of FIG. 1 showing several operational aspects of the apparatus;

FIG. 3 is an isometric view of a panel positioning block;

FIG. 4 is an enlarged sectional view showing a portion of the panel positioning block as taken along the line 4—4 of FIG. 3;

FIG. 5 is an enlarged sectional showing the seating of the panel edge in the *V* of the positioning block as illustrated in FIGS. 2*b* and 2*c;* and

FIG. 6 is a sectional view illustrating the panel rinsing operation following panel cleaning in the apparatus.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

For a better understanding of the present invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following specification and appended claims in connection with the aforedescribed drawings.

With particular reference to FIG. 1, there is shown an exploded isometric view of the constructional aspects of the panel cleaning apparatus **11**. In conjunction therewith, FIGS. 2*a*, 2*b* and 2*c* delineate the relationship of the several components comprising the apparatus assembly and the solvent solution **12** contained therein.

An open-top liquid container or tank **13**, horizontally oriented and affixally located on a base member **15**, is formed of stainless steel or a chemically resistent and substantially rigid plastic material such as P.V.C. The

container is constructed to hold a quantity of the liquid solvent solution **12** at a predetermined level as evidenced by the outflow orifice **17.** One embodiment of the open top container is shaped as a continuous channel **19** forming a ring-like structure whereof the inner sidewall **21** defines a substantially vertically oriented centralized tubular-like structure **23,** the opening providing venting means, the function of which will be described later in this specification.

A frame member **27** is constructed of a perimetrical portion **29** with a plurality of spatially related lateral structural elements **31** joined to an annular member **33.** This annular member is formed to accommodate vertical movement of the frame **27** relative to the tubular vent **23.** The frame is supported by a plurality of spaced apart supportive means **37,** each comprising an edge-oriented guide bracket **39** with a bore **41** therein to slidably accommodate a guide rod **43** extended therethrough. Each of the respective guide rods is positioned by a holding means **45** which is attached to the base member **15** exteriorly of the container **13.** A resilient element such as a helical spring **47,** encompassing each guide rod **43,** provides the support for each of the frame guide brackets **39** thereby effecting suspension of the frame member **27** within the container in a manner to facilitate vertical reciprocating movement of the frame therein.

At least one multi-apertured or mesh-like member **51** is shaped and laterally positioned on and attached to the frame member in a manner to be vertically movable with the frame. The mesh member, which is formed, for example, of stainless steel, has a cut out portion **53** to facilitate movement thereof relative to the tubular vent **23.** This mesh functions as a means for expeditiously breaking the surface tension of the solvent **12** in the container **13** during operation of the apparatus. Positioned atop the mesh member are a plurality of panel positioning blocks **55** in spaced apart relationship. These blocks, being made of a material such as nylon, are affixed to the structural elements of the frame member **27** by bolt means **57** extended through suitable holes **58** in the blocks and the related mesh member **51** thereby also effecting attachment of the mesh to the frame. Additionally referring to FIGS. **3, 4,** and **5,** each of the blocks **55** has at least one locating *V* configuration **59** formed therein to accommodate portions of the sealing edge **63** of the face panel **65** in a limited contact manner, the perimetrical sealing edge of the panel being positioned within the *V* to make limited contact with each leg *a* and *b* thereof. Such limited contact is important in promoting efficient areal solvent treatment for effecting removal of the extraneous coating from the edge region of the panel. To further enhance limited contact, the sealing edge **66** of the locating *V* is beveled or chamfered along both edges **67.**

A shielding member **71,** of a material such as epoxy, is positioned within the viewing panel **65** to protect the coating, not shown, disposed on the interior surface of the viewing area **73** thereof and on the sidewall portion **75** contiguous thereto. This protective shield, while being smaller than the interior dimensions of the panel, is contoured of a shape similar to that of the interior surface of the panel, and is positioned in a manner spatially related to the interior surface of the panel and the adjacent solvent solution **12** in the container **13.** The shielding member **71** is spaced above and substantially central to the frame member **27** and suitably affixed thereto by a plurality of supportive brackets **79.** Therefore, during operation of the apparatus, the shield and the frame member are moved vertically and simultaneously in a constant spatial relationship, whereof the shielding member is always above the level of the solvent solution **12.** The tubular vent construction **23** is oriented to open beneath the shielding member.

The tube face panel **65** being of "skirted" construction has a surrounding sidewall portion **75** perimetrically extending from the periphery of the viewing area **73.** The panel is predeterminately positioned in a horizontal inverted manner with the sidewall sealing edge **63** oriented in a downward direction over the shielding member **71.** This panel positioning is accomplished, for example, by panel supportive means **81** formed as a vacuum holding arrangement functioning in conjunction with the outer surface of the panel. Such panel supportive means is adaptive to usage for accurately positioning the panel and sequentially moving the same through a number of related stations in an automated manufacturing operation.

The container **13** and associated frame member **27** are positionally related to base member **15** which, in turn, is supported by apparatus support means **85.**

For the apparatus to function, it is necessary to effect relative movement between the panel and the solution container to facilitate immersion of the edge-related area of the panel in the solvent solution. The panel edge immersion can be accomplished in either of two procedures. For example, as shown in FIGS. **2***a*, **2***b*, and **2***c*, the panel **65** is located by support means **81** in a constant position, and the apparatus support means **85** is moved vertically by a controlled reciprocating movement means, not shown, to enable the liquid solution **12** to make contact with the stationary sealing edge region of the panel **65.** Such vertical reciprocation is achieved by conventional fluid or mechanical means readily conjunctive with the apparatus support means. Another procedure for effecting the relative movement between the panel and the solvent is to maintain the solvent container **13** at a constant level; whereupon, the panel support means **81** is moved in a predetermined vertical manner by controlled reciprocating means, not shown, to enable the panel edge region to be immersed in and removed from the solvent. Such movement can be readily understood by reference to the figures.

Reference is directed to FIGS. **2***a*, **2***b*, and **2***c* for further explanation of the apparatus for cleaning the coating from substantially the sealing edge region of a cathode ray tube face panel. With particular reference to FIG. **2***a*, a cathode ray tube face panel **65** is, for example, at that stage of screen fabrication wherein the opaque coating material, such as graphite and a binder, has been disposed over the polymerized PVA pattern of window elements. The graphite coating material, not shown, covers the whole of the interior of the panel including the sealing edge region from which it is removed by the invention. The panel **65** is placed and held by supportive means **81** in a horizontal position with the sidewall edge **63** oriented in a downward direction over an open-top container **13** having therein a controlled and predetermined level of liquid solvent solution **12.**

The solvent is substantially a weak acidic solution to soften the bonding of the graphite associated binder. For example an aqueous solution comprising about one

percent by volume of hydrofluoric acid and one percent by volume of sulfuric acid has been found satisfactory for the process.

Immediately beneath the panel, the contoured shielding member **71** of the apparatus is spatially and centrally oriented to subsequently protect the graphite coating disposed on the panel viewing area **73** from any spurious splashings of the solvent material. In FIG. **2***b*, the solvent container is raised toward the panel to effect seating contact therewith in the appropriate *V* configurations **59** formed in the panel positioning blocks **55.** The operation continues from FIGS. **2***b* to **2***c* wherein the container is further raised, to the full of the upward movement. As discrete and limited areas of the panel edge **63** are pressured on the positioning blocks **55,** the helical springs **47** of the frame supportive means **35** are compressed and the frame member **27,** which is initially above the solvent level at the beginning of the cycle, is lowered into the solvent **12** carrying with it the mesh-like member **51.** As the mesh makes immersive contact with the solvent, it breaks the surface tension thereof in a turbulent-free manner, and as the panel edge is immersed immediately thereafter, there is a minimum of surface turbulence when the sealing region enters thereinto. The interior of the panel is vented to ambient atmospheric pressure by vent construction **23** which facilitates the rise of the solvent to the desired level on the interior coated surface of the sidewall.

After immersing the panel edge region for a time period in the order of two to four seconds, the reverse of the process is initiated for removing the panel from the solvent. As the container **13** is lowered, the panel emerges from the solvent before the mesh and associated frame member, whereupon the solvent liquid drains from the panel through the mesh member. The panel positioning blocks and the adjacent mesh break the surface tension that holds the solvent solution to the panel sealing edge, thus the mesh prevents the formation of bubbles and resultant surface turbulence as the apparatus returns to the starting position. Minimizing turbulence associated with disruption of the surface tension of the solvent immediately associated with immersion and egression of the panel edge therewith reduces the prevalence of minute splashing of the interior of the panel. The solvent reacts on the bonding of the graphite coating, loosening but not removing it from the seal edge region, therefore, the solvent does not become unduly contaminated with graphite material.

After the coated panel is subjected to treatment in the solution, it is moved to an adjacent station **89,** as indicated in FIG. **6,** whereupon the panel is rinsed with water supplied by flow means **91.** This rinsing step removes the loosened extraneous graphite coating from the region of the seal edge **63.** Thus, the edge of each panel is expeditiously cleaned in a repetitive uniform manner.

While there has been shown and described what are at present considered the preferred embodiments 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 scope of the invention as defined by the appended claims.

What is claimed is:

**1.** In relation to a cathode ray tube panel formed of a viewing area with a perimetrical sidewall terminated by a sealing edge therearound and having a coating disposed over the interior surface of the panel, an apparatus for cleaning the coating from substantially the sealing edge region of said panel sidewall, said apparatus comprising:

panel supportive means for locating said panel in a horizontal position with said sidewall edge oriented in a downward direction;

an open-top container oriented beneath said panel supportive means and adapted to contain a quantity of a solvent liquid at a predetermined level therein, said container including at least one substantially vertically and centrally oriented tubular-like venting means positioned to extend above said liquid level therein;

a frame member formed for suspension within the confines of said container in a manner to effect predetermined and restricted vertical reciprocating movement therein, said frame being constructed of a perimetrical portion having a plurality of spatially related lateral structural elements connective therewith, said frame member having said panel supportive means associated therewith;

supportive means for said frame formed of guided resilient elements located externally of the interior of said container;

a mesh-like member positioned laterally on said frame member in a manner to be vertically movable therewith, said mesh-like member being oriented beneath said panel supportive means;

a plurality of panel positioning means oriented atop said meshlike member in a spaced-apart relationship and affixed to said frame member in positions to make contact with said panel;

a shielding member having an exterior contour related to that effected by the interior surface of said panel, said shielding member being spaced above and affixed to said frame member at a location substantially central thereto in a manner to be vertically movable therewith in the region above the level of said liquid, said venting means opening beneath said shielding member;

apparatus support means associated with said container; and

means for effecting relative movement between said panel and associated mesh-like member with said container to facilitate immersion and withdrawal of said mesh-like member and the edge-related area of said panel into and out of said liquid solvent solution.

**2.** The panel cleaning apparatus according to claim **1** wherein said panel positioning means are discretely formed blocks having provisions therein to make contact with selected portions of substantially the sealing edge of said panel to properly position the edge-related area thereof for cleaning.

**3.** In the panel cleaning apparatus according to claim **2,** wherein each of said panel positioning blocks has at least one locating *V* formed therein to accommodate the sealing edge of the panel in a limited contact manner, the perimetrical sealing edge of said panel being positioned within the *V* to make contact with each leg thereof.

**4.** In the panel cleaning apparatus according to claim **1,** wherein said open-top container is shaped as a continuous liquid-containing channel forming a ring-like structure whereof the inner sidewall defines a substantially vertically oriented centralized tubular-like struc-

ture the opening of which provides said venting means, said frame and said mesh-like member each having provisions therein to accommodate said tubular structure therethrough and provide for vertical movement of said frame and mesh relative to said tubular structure, said shielding member being spatially oriented above the opening in said tubular structure.

**5.** In the panel cleaning apparatus according to claim **1**, wherein the supportive means for said frame comprise a plurality of vertically positioned helical springs each having a fixed vertical guide rod therein, said frame having a plurality of edge-oriented guide brackets each with a bore therethrough to match a respective guide rod thereby facilitating reciprocating movement of said frame.

**6.** In the panel cleaning apparatus according to claim **1**, wherein movement between said panel and said container is effected by a vertically reciprocating movement means predeterminately raising and lowering said container to enable the liquid therein to make contact with the sealing edge region of said panel.

* * * * *