March 26, 1963 D. L. BRACHT ET AL 3,082,513

FIXTURE

Filed Dec. 21, 1959 3 Sheets-Sheet 1

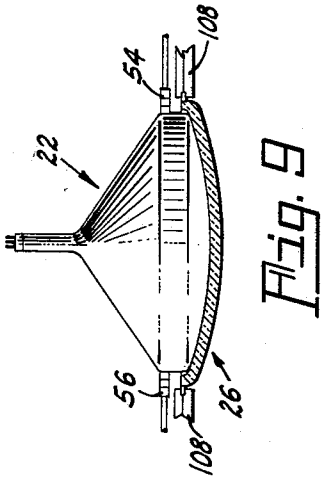


Fig. 9

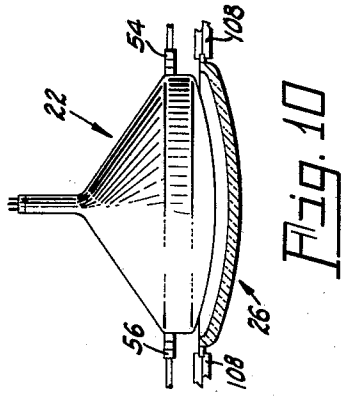


Fig. 10

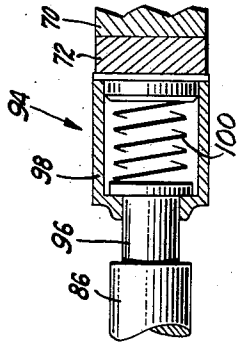


Fig. 5

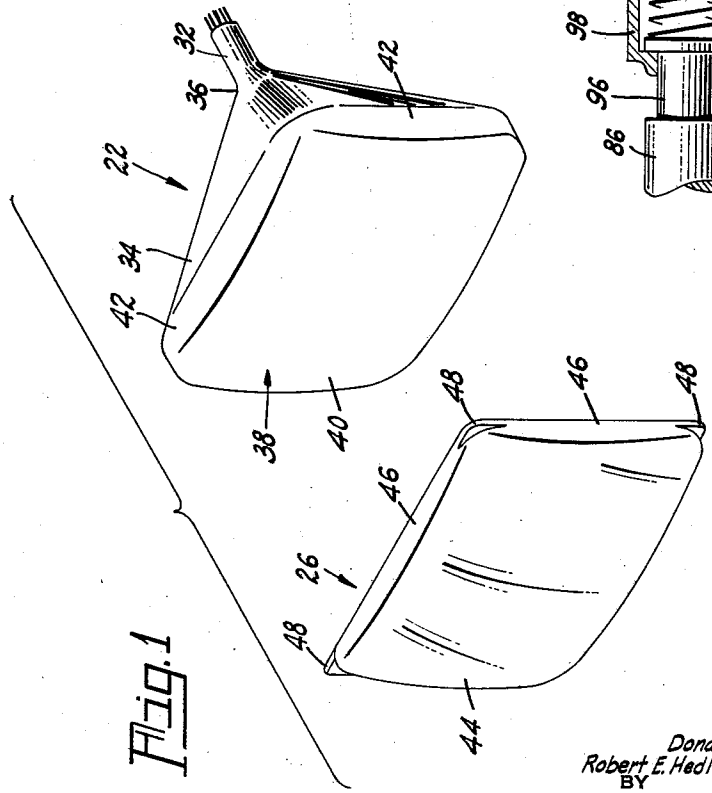


Fig. 1

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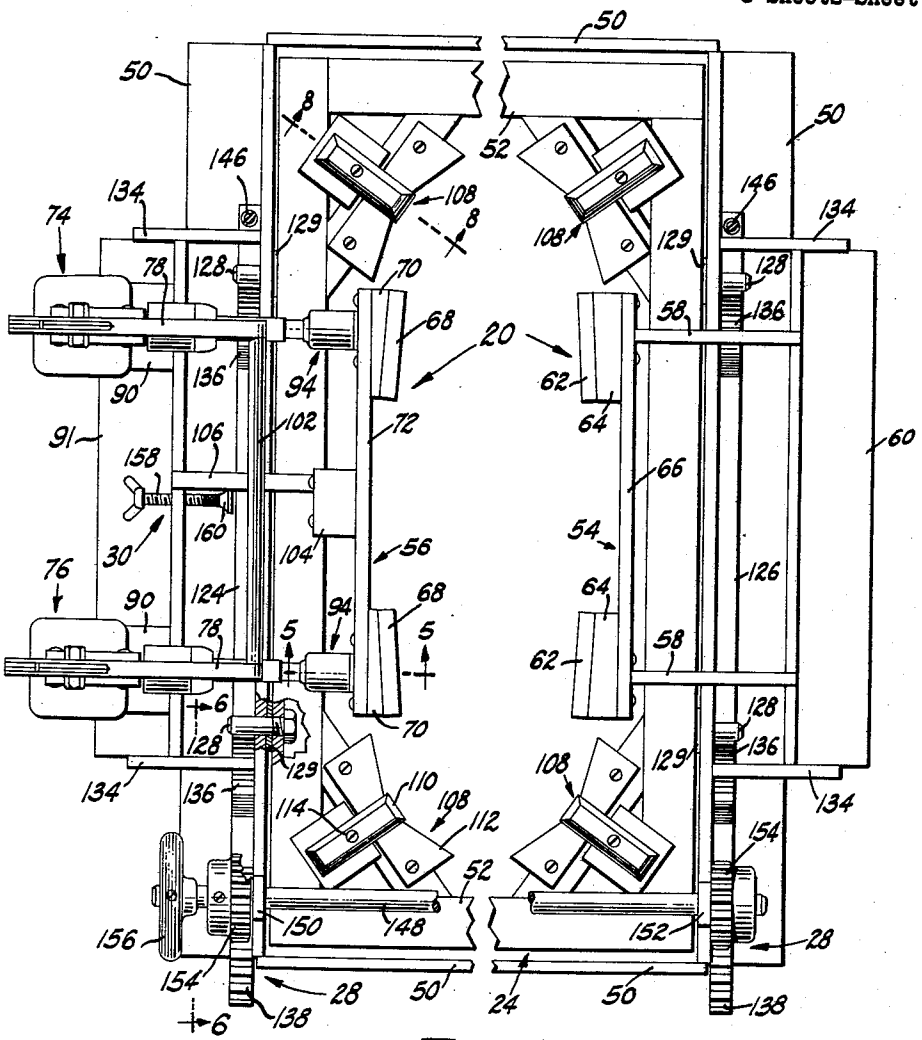
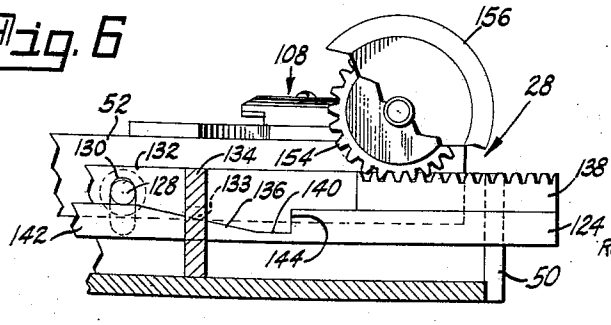


Fig. 2

Fig. 6



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FIXTURE

Filed Dec. 21, 1959 3 Sheets-Sheet 3

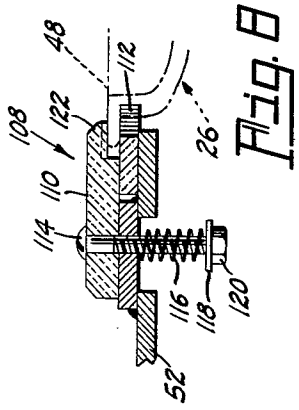


Fig. 8

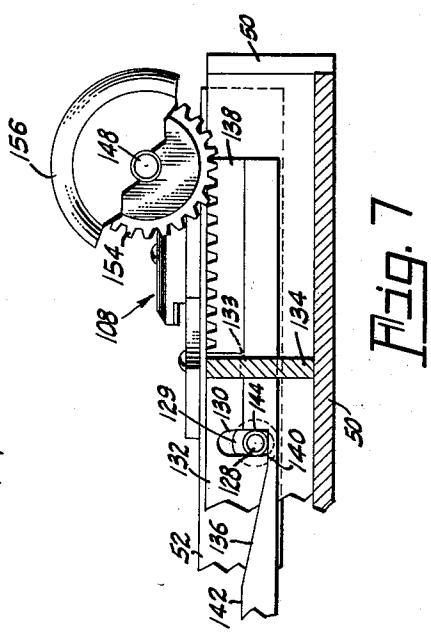


Fig. 7

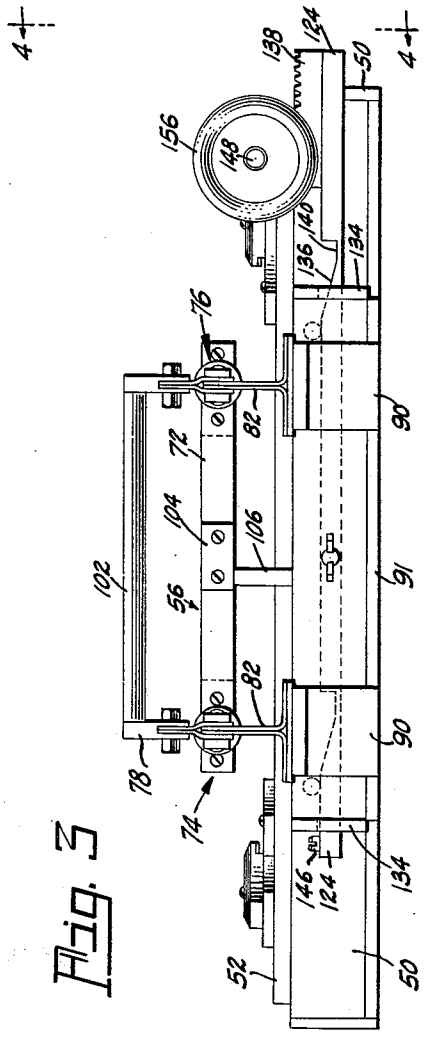


Fig. 3

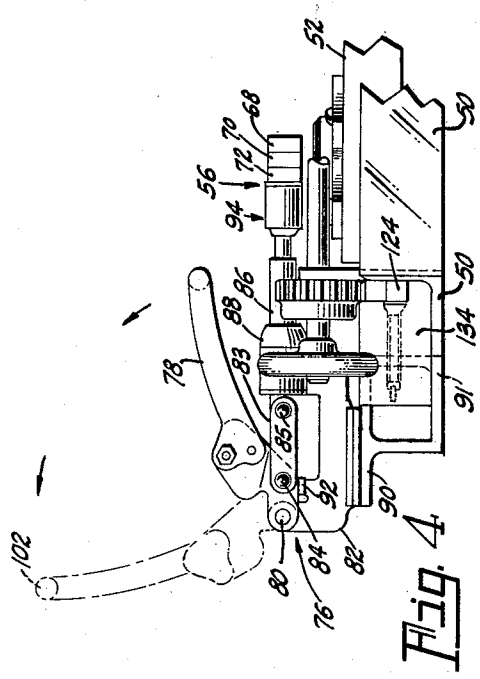


Fig. 4

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FIXTURE

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5 Claims. (Cl. 29—203)

This invention relates to assembly fixtures and more particularly to a fixture for positioning a cathode ray tube and a contoured safety panel before and during a bonding operation.

Heretofore, television receiver sets have been equipped with a separable safety panel or shield positioned between the face plate of the cathode ray tube and the set viewer. The safety panels were designed to protect the viewer from the danger of implosion of the cathode ray tube. These safety panels were spaced from the face plates of the cathode ray tubes by various means. However, the spacing means generally proved to be unsatisfactory since dust was able to enter between the face plate and the safety panel. Furthermore, troublesome reflections occurred between the surfaces of the safety panel and the face plate. These reflections tended to distract the viewer and to make viewing difficult through degradation of the image contrast. Additionally, styling trends have required that the overall depth of the television receiver be reduced. This has led to the introduction of cathode ray tubes having shorter and shorter neck portions as one solution. The neck portion having reached what is at present considered the practical ultimate in shortness, it was necessary that efforts be made to decrease the depth of the receiver by diminishing the space between the front mounted separate safety panel and the face plate of the picture tube.

A proposed solution to the above mentioned difficulties is the provision of a safety panel which is laminated or bonded by transparent material directly to the contoured face plate of the cathode ray tube. A contoured safety panel is utilized to minimize the overall size of the finished assembly and reduce reflection. In order to properly perform the laminating operation, it is necessary that the cathode ray tube and the contoured safety panel be accurately positioned with respect to one another. Supporting means heretofore used in this precise operation have been extremely cumbersome and generally inaccurate. Therefore, it is an object of this invention to accurately position a cathode ray tube and the safety panel to which it is to be bonded.

The laminating operations require accurate control of the relative positions of the safety panel and the cathode ray tube. At certain points in the processing cycle it is necessary that the safety panel be uniformly spaced a short distance from the face plate of the tube. At other points of the cycle it is necessary that the safety panel be spaced further away from the face plate and also that the face plate and safety panel be able to be moved relative to one another to adjust the spacing therebetween. Therefore, it is another object of this invention to provide apparatus for precisely adjusting the position of the safety panel and cathode ray tube to which it is to be bonded with respect to one another.

The production rate of cathode ray tubes and bonded face plate assemblies is dependent upon the laminating process. It is necessary that each of the units be positioned properly and quickly to insure an economic production rate. Therefore, it is still another object of this invention to increase the speed of positioning the cathode ray tube and contoured safety panel with respect to one another.

Due to the nature of the bonding material used to form the laminated or bonded shield tube, it must be possible to quickly remove the cathode ray tube from the assembly fixture if it should be determined that an improper or poor seal would develop between the two units when the bonding material hardens. Therefore, it is yet another object of this invention to provide an assembly fixture which accurately positions a cathode ray tube with respect to a contoured safety panel yet allows the cathode ray tube to be removed easily without disassembly of the entire fixture.

These and other objects of the invention are fulfilled in one aspect of the invention by the provision of a fixture for positioning a safety panel with respect to the face plate of a cathode ray tube having a longitudinal axis including the combination of means for holding the cathode ray tube with its longitudinal axis in a given direction, means for supporting the safety panel in a plane transverse to the longitudinal axis of the cathode ray tube, means for producing relative movement between the cathode ray tube and the safety panel along the longitudinal axis, and means for locking the moving means against relative movement.

For a better understanding of the invention reference is made to the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is an exploded perspective view showing a contoured safety panel and associated cathode ray tube before the bonding operation;

FIG. 2 is a plan view of the assembly fixture;

FIG. 3 is a side elevation of the assembly fixture;

FIG. 4 is an end elevation of a portion of the assembly fixture showing the operation of the clamping means;

FIG. 5 is a view in section of a portion of the clamping means taken along the line 5—5 of FIG. 2;

FIG. 6 is a side elevation of the inner frame moving means in the raised position taken along the line 6—6 of FIG. 2;

FIG. 7 is a view similar to FIG. 5 of the same apparatus in the lowered position;

FIG. 8 is a view in section showing the contoured face panel clamping means taken along the line 8—8 of FIG. 2; and

FIGS. 9 and 10 are fragmentary diagrammatic representations of the operation of the assembly apparatus.

During the laminating operation it is necessary to bring both the safety panel and the cathode ray tube to an elevated temperature. For uniform heating, the face plate and safety panel must be separated slightly. After heating, the parts are separated further and the laminating material is introduced therebetween. The safety panel and the face plate are then brought closer together and held immovable relative to one another until the laminating material has cured or hardened.

Referring to the drawings, the cathode ray tube to safety panel assembly fixture comprises means 20 for holding the cathode ray tube 22 with its longitudinal axis substantially vertical, means 24 for supporting the safety panel 26 in a plane transverse to the longitudinal axis of the cathode ray tube 22, means 28 for producing relative movement between the cathode ray tube 22 and the safety panel 26 along the longitudinal axis, and means 30 for locking the moving means 28 against movement.

FIG. 1 illustrates a typical cathode ray tube 22 to which a safety panel 26 is to be laminated. The cathode ray tube envelope has a neck portion 32, containing an electron gun (not shown) joined to the funnel or bell portion 34 through the flare zone 36. The phosphor coated face plate 38 has a contoured front surface 40 and substantially straight side portions 42 which are joined to the bell portion 34. The laminating or bonding operation is usually performed upon a completely processed operable cathode ray tube. However, it may be performed upon a

partially processed or unprocessed tube depending upon the availability of laminating material which can safely withstand the tube processing temperatures.

Safety panel **26** is formed from glass or similar transparent material with a contoured face **44** which close approximates the contour of the cathode ray tube face plate **40**. The substantially straight upstanding portions **46** of the safety panel **26** are slightly shorter than the corresponding side portions **42** of the cathode ray tube so that the face plate **40** will be encompassed by the safety panel **26** while still allowing a tube clamping surface to be available for the laminating operation to follow.

The configuration of the safety panel **26** may be described generally as being cup-shaped and having outturned lip portions or ears **48**. Ears **48** are used in locating the safety panel **26** with respect to the cathode ray tube during the laminating operation and in mounting the finished device in a television receiver. The ears are provided at each corner of the safety panel adjacent its open end.

The assembly fixture includes an outer frame **50** on which the cathode ray tube holding means **20** is mounted and a relatively movable inner frame **52** which is part of the safety panel supporting means **24**. Cathode ray tube holding means **20** is mounted on the fixture outer frame **50** and comprises substantially a fixed jaw **54** and a relatively movable jaw **56** which lie in the same plane. Fixed jaw **54** includes support arms **58** secured to an L-shaped bracket **60** where in drawing mounted on the outer frame **50**. Cathode ray tube clamping pads **62** are affixed to wedge-shaped spacer members **64**. Spacers **64** are secured to a stiffener **66** carried by support arms **58**. The spacers **64** incline the pads **62** with respect to the stiffener **66**, so as to present a maximum contacting surface to the wall portions **42** of the cathode ray tube **22**. The inclination of the pads **62** is required in order to compensate for the slight curvature of the walls **42** about the longitudinal axis of the tube. Pads **62** are fabricated from high temperature deterioration resistant resilient material such as silicone rubber having durometer readings in the range of 40 to 65 to allow for compliance with the tube contour.

The movable jaw **56** is provided with clamping pads **68** similar to those which formed a part of the fixed jaw **54**. Clamping pads **68** are inclined by wedge-shaped spacer members **70** with respect to a stiffener **72** in order to compensate for the curvature of the walls **42** of the tube.

Movement of the jaw **56** is produced by a pair of toggle type clamps **74**, **76** (see FIGS. 2, 3 and 4). Clamps **74**, **76** may be identical in all respects. Each is provided with an operating lever **78** which is pivoted about a pin **80** on the clamp frame **82** (FIG. 4). A strap link **83** is pivotally secured at one end to a pin **84** carried by the lever **78** and at the other end to a pin **85** carried by clamp rod **86**. Rod **86** is slidably held in a bushing **88** secured to the clamp frame which is in turn affixed to a T-shaped bracket **90**. Bracket **90** is affixed to angle member **91** which is attached to the outer frame **50**. Clamp frame **82** is also provided with a stop **92** which limits the over-center travel of the link **84** through contact with the lever **78**.

Each of the clamp rods **86** is connected to the stiffener **72** through a spring loaded member **94** (see FIG. 5). Rod **86** is connected to plunger **96** which is slideable in a housing **98** secured to the stiffener **72**. Movement of the plunger **96** is transmitted to the stiffener **72** through a spring **100** contained within the housing **98**.

The normal or unlocked position of the toggle clamp lever **78** is shown in phantom in FIG. 4. In moving from the unlocked position to the locked or clamping position the lever **78** is pivoted about the frame supported pin **80**. This pivotal movement causes the rod **86** to move the stiffener **72** toward the right in FIG. 2 until the pads **68** contact the walls **42** of a tube **22**. Continued movement of the rod **86** compresses the spring **100** when movement of the stiffener **72** is arrested. The maximum extension of rod **86** occurs when the center of pin **84** is on a line with the center of pins **80** and **85**. This is an unstable position of the toggle mechanism. Continued movement of lever **78** passes the pin **84** through the center line. This is considered the overcenter position and allows the rod **86** to be moved backward, from maximum extension, by the force of the spring **100**. Further pivotal movement of lever **78** is prevented by stop **92**. Spring **100** acting through rod **86** and link **84** keeps the lever **78** against the stop **92** at the same time exerting the clamping pressure required to maintain a tube **22** between the movable jaw **56** and the fixed jaw **54**. Operation of the tube toggle clamps **72**, **74** is coordinated by a common operating handle **102** connected between the ends of the levers **78**.

Support block **104** is affixed to the stiffener **72** and cooperates with the outer frame mounted guide rail **106** to prevent deflection of the movable jaw **56** which might otherwise occur due to the considerable weight of a cathode ray tube when clamped in the holding means **20**. Guide block **104** slides on the upper surface of the guide rail **106** as the jaw **56** moves forward.

Safety panel supporting means **24** comprises a combination including a plurality of panel clamps **108** and the movable inner frame **52**. Each of the frame mounted clamps **108** is identical and comprises a movable jaw or dog **110** and a fixed clamping surface **112** (FIG. 8). Dogs **110** and clamping surfaces **112** are fabricated from a relatively hard heat insulative material such as linenized Bakelite to assure uniform heating of the safety panel **26** during the laminating operation. It is essential to the formation of a good bond that there be no relatively cool or hot spots on the parts to be joined. The fixed jaw or clamping surface **112** is secured to the inner frame **52**.

The movable jaw or dog **110** is pivotally mounted about a screw **114**. Screw **114** is resiliently mounted to the inner frame **52** by a spring **116** which reacts between the frame and a washer **118** held on the screw by a nut **120**. This construction allows the dog to pivot about the screw while the spring **116** provides the clamping force to maintain an ear **48** of the safety panel **26** between the beveled end **122** of the dog and the clamping surface **112**. A bevel formed on the end of the dog eases the passage of the dog onto the ear **48** by providing an inclined ear contacting portion. In the embodiment of the invention illustrated in the drawings, four clamps **108** are provided, each positioned in a corner of the inner frame **52** to cooperate with the ears **48** of the safety panel. The number of clamps **108** generally corresponds to the number of ears **48** on the safety panel **26** and may be altered accordingly.

The means **28** for producing relative movement between the safety panel supporting means **24** on the inner frame **52** and the cathode ray tube holding means **20** on the outer frame **50** comprises a pair of cam bars **124**, **126** movable relative to the outer frame **50**. Cam bars **124**, **126** cooperate with cam pins **128** affixed to the inner frame **52**. Cam pins **128** extend from the inner frame through slots **130** in the vertical wall **132** of the outer frame **50**. Four spaced cam pins or followers **128** are used to equalize the vertical motion of the inner frame **52** as will be explained later. Frame spacers **129** are carried by the pins **128** intermediate the inner frame and the outer frame. Each of the cam bars pass through openings **133** in guide plates **134** which are affixed to the outer frame **50**. The cam bars **124**, **126** illustrated are generally rectangular in cross section and have inclined portions **136** formed thereon. Inclined portions **136** cooperate with the cam pins **128** to produce movement of the inner frame relative to the outer frame when the cam bars are driven. One end of each cam bar has a toothed rack **138** affixed thereto. A dwell area **140** is formed in the cam bar at the bottom of each inclined portion **136** defining the lowermost position of the inner frame. The top surface **142** of the cam bar determines

the other limit of travel of the inner frame relative to the outer frame. The back surface 144 of the dwell area 140 acts as a cam bar stop to limit the movement of the cam bars in one direction while stop screws 146 limit the travel of the cam bars in the other direction by contact with the guide plates 134.

Cam bars 124, 126 are driven simultaneously by a common drive means. The drive means comprises a shaft 148 journaled in bearings 150, 152 affixed to the outer frame 50. Pinion gears 154 secured to the shaft 148 mesh with the racks 138 affixed to the ends of the cam bars 124, 126. A knob handle 156 is secured to one end of the shaft 148. Turning the knob 156 rotates the gears 154 thus sliding the cam bars 124, 126 in the openings 133 in the guide plates 134. The cam pins 128 on the inner frame 52 are constrained to vertical movement only by the slots 130 in the outer frame wall 132. In this way horizontal movement of the cam bars 124, 126 is converted to the vertical movement of the inner frame 52. Since the cam bars 124, 126 are duplicates and the cam pins 128 are similarly positioned on both sides of the inner frame 52, equidistant from the ends of the frame, and in the same relative position on each of the inclined portions 136 of the cam bars, the movement of each corner of the inner frame 52 is produced equally, i.e., there is no tilting of the inner frame which is normal to the longitudinal axis of the tube and thus no tilting of the safety panel 26 is possible. If necessary, spring means (not shown) may be provided between the inner frame and the outer frame to fix their position relative to one another in the plane transverse to the longitudinal axis of the tube.

The means 30 for locking the moving means 28 to hold the supporting means 24 at selected positions along the longitudinal axis of the cathode ray tube includes a thumb screw or clamp 158 which threadedly engages the angle member 91. The thumb screw is provided with a swivel head 160. When the thumb screw 158 is operated, the head 160 is pressed against the cam bar 124. When sufficient pressure is applied, the cam bar 124 is clamped between the head 160 and the wall 132 of the outer frame 50. Since cam bars 124 and 126 are interconnected, they will both be locked, thus preventing movement of the inner frame 52 away from the tube holding means 20.

The above-described assembly fixture is utilized in the following manner. The fixture is held horizontally by means not shown, and the inner frame 52 is racked to its upper-most position by the cam bars 124, 126 as shown in FIG. 6. A safety panel 26 is positioned, open end up, on the frame 52 with its mounting ears 48 resting on the clamping surface 112 of the clamps 108, the dogs 110 having been previously pivoted to an inoperative position. A cathode ray tube 22 is then placed in the fixture between the fixed jaw 54 and retracted movable jaw 56 of the holding means 20. The tube is positioned with its longitudinal axis vertical and with its contoured face plate 40 lowermost. Contoured face plate 40 of the tube rests against the matching contour of the safety panel 26. The position of the safety panel relative to the tube is adjusted by spacing means (not shown) which are inserted between the walls 42 of the tube and the walls 46 of the safety panel. Cathode ray tube 22 is clamped in the holding means 20, while the spacing means are present, by operating the toggle clamps 74, 76. The clamping pads 62, 68 contact the walls 42 of the tube and are deformed by the clamping pressure to securely hold the tube in position. The clamping pressure applied to the tube walls 42 is limited by the spring 100 positioned in the spring loaded member 94 between the clamp rods 86 and the stiffener 72. A pressure of from 100 to 140 pounds is required to maintain a 21 pound tube in position.

The safety panel position in the plane transverse to the tube is determined by the spacing means, and the clamping dogs 110 are then pivoted to hold the ears 48 of the panel 26 securely against the clamping surfaces 112. Once the panel 26 has been clamped the spacing means are removed (FIG. 9).

The clamped safety panel 26 and the cathode ray tube are then separated by turning the knob 156 (FIG. 10). This rotates the gears 154 borne by the connecting shaft 148, thus driving the cam bars 124, 126 to the left as shown in FIG. 7 from the position shown in FIG. 6. In FIG. 7 the cam bars 124, 126 are shown at their extreme position with the cam pins 128, which are affixed to the inner frame, in the dwell area 140 of the cam bar. The equal spacing and similar positioning of the contoured inclined portions 136 of the cam bars 124, 126 and the positions of the cam pins 128 produce a movement of the inner frame 52 and safety panel 26 relative to the cathode ray tube along its longitudinal axis while retaining the safety panel in a plane which is transverse and normal to the longitudinal axis of the tube. The safety panel moving means 28 may be locked in any position by locking the cam bars between their extremes by the use of the locking means 30.

Removal of the tube and shield assembly from the fixture after the laminating process has been completed is accomplished by releasing the tube holding means 20 and unclamping the shield ears 48. The assembly may then be lifted vertically out of the fixture.

The tube alone may be removed from the fixture at any time before the laminating operation is finished by merely releasing the holding means 20. The safety panel 26 remains held in the fixture so that the laminate seal may be broken by merely rocking the tube 22 to one side and then lifting it vertically.

During the performance of the laminating process the entire fixture and component parts thereof are heated to a temperature of approximately 200° F. prior to the introduction of the laminating material. It is therefore necessary that the clamping pads 62, 68 be fabricated from heat resistant material. Clamping dogs 110 and the clamping surfaces 112 are also fabricated from heat resistant material, but material used therein which is stiffer than that employed in fabricating the clamping pads.

The invention disclosed herein is capable of accurately positioning parts which are to be assembled to one another and more particularly for accurately locating and moving a safety panel with respect to a cathode ray tube to which it is to be bonded. The precise positioning operation required may be quickly performed by unskilled personnel. The fixture also allows quick removal of the cathode ray tube alone should that be desirable at any time during the processing cycle.

It will be apparent to those skilled in the art that 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 a fixture for positioning a panel with respect to a cathode ray tube face plate having an axis lying traverse to the plane of said face plate, the combination comprising tube holding means for fixedly supporting said cathode ray tube with the face plate lowermost including circumferentially disposed spaced pads formed to laterally contact the periphery of said tube, movable panel support means positioned below the tube holding means for supporting said panel relative to said face plate, said movable panel support means having circumferentially disposed clamps formed to removably contact peripheral portions of said panel, said clamps being spaced outwardly farther from said face plate axis than the face plate pads, and means operably connected to said panel support means formed to raise and lower the panel substantially along said face plate axis relative to the fixedly held tube face plate.

2. In a fixture for positioning a safety panel with respect to the face plate of a cathode ray tube having a

longitudinal axis the combination comprising an outer frame, cathode ray tube supporting means mounted on said outer frame, a safety panel supporting inner frame relatively movable with respect to said outer frame, and cam means mounted on said outer frame for moving said inner frame relative to said outer frame.

3. In a fixture for positioning a safety panel with respect to the face plate of a cathode ray tube the combination comprising an outer frame, toggle operated cathode ray tube clamping means mounted on said outer frame, an inner frame movable relative to said outer frame, means on said inner frame for supporting said safety panel, cam followers mounted on said inner frame, means for moving said inner frame with respect to said outer frame comprising parallel spaced cam bars each having cam follower contacting portions and slidably mounted on said outer frame, said cam bars having one end formed into a rack, cam bar driving means mounted on said outer frame including a common operating shaft, spur gears mounted on said shaft in operative relation to the rack portion of said cam bars and handle means mounted on said shaft whereby movement of said handle produces simultaneous movement of said cam bars, and means mounted on said outer frame for locking said cam bars against movement.

4. In a fixture for positioning a safety panel with respect to the face plate of a cathode ray tube the combination comprising an outer frame, cathode ray tube holding means mounted on said outer frame, an inner frame movable relative to said outer frame, means for

supporting said safety panel on said inner frame, cam followers mounted on said inner frame, cam bars slidably mounted on said outer frame having cam follower contacting portions, means for moving said cam bars whereby said relative movement between said inner frame and said outer frame is produced, and means mounted on said outer frame for locking said cam bars against movement.

5. In a fixture for positioning a safety panel with respect to the face plate of a cathode ray tube the combination comprising a rectangular outer frame, cathode ray tube holding means mounted on said outer frame, a rectangular inner frame movable with respect to said outer frame, means for supporting said safety panel on said inner frame, a plurality of cam followers mounted on opposed sides of said inner frame, cam bars slidably mounted on said outer frame in cooperative relationship with said cam followers, means for moving said cam bars whereby said relative movement between said inner frame and said outer frame is produced, and means mounted on said outer frame for locking said cam bars against movement.

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