Jan. 28, 1958 K. M. HENRY ET AL 2,821,644

MOUNTINGS FOR PICTURE TUBE GRIDS

Filed Nov. 10, 1954 4 Sheets-Sheet 1

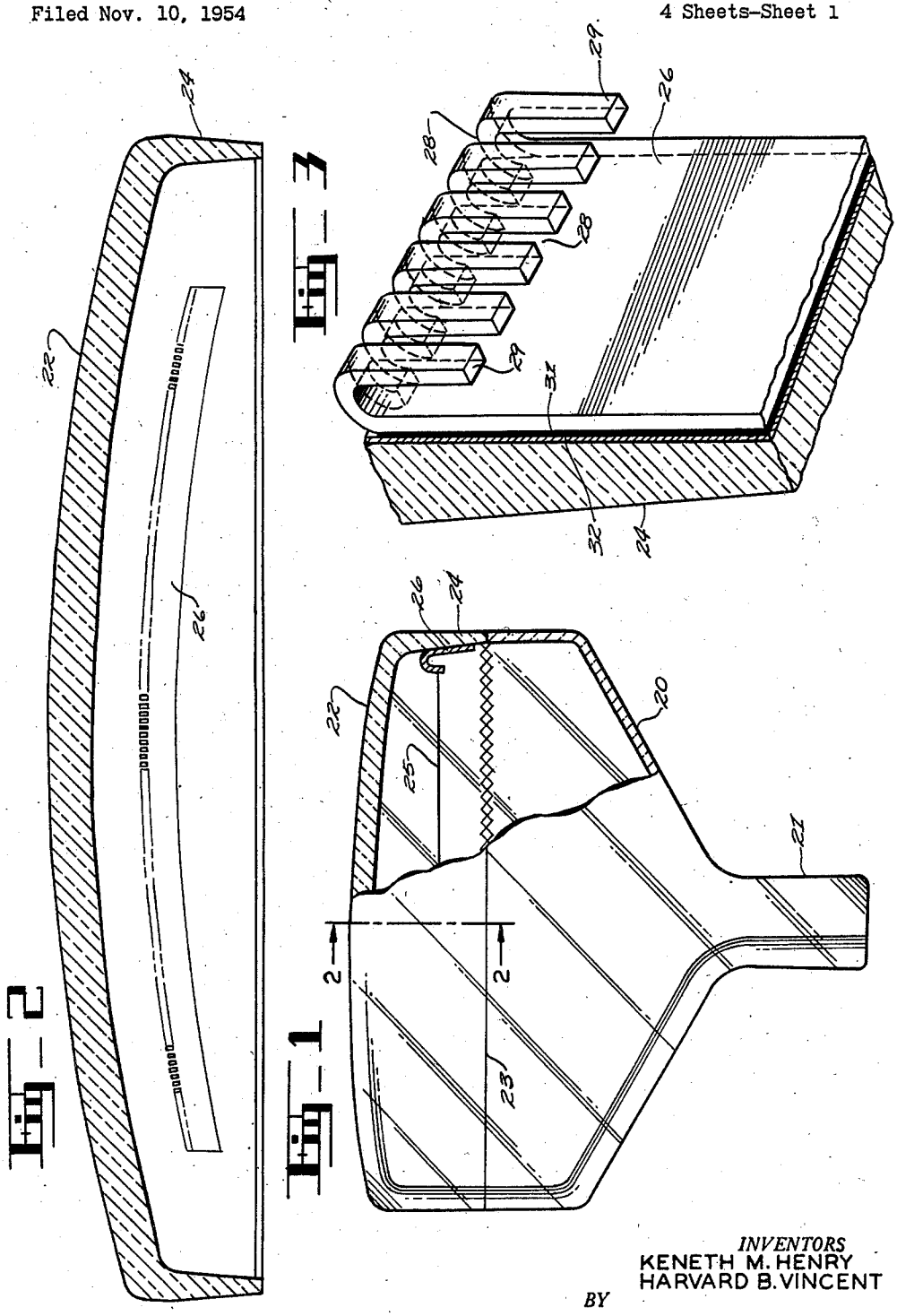

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Fig. 4

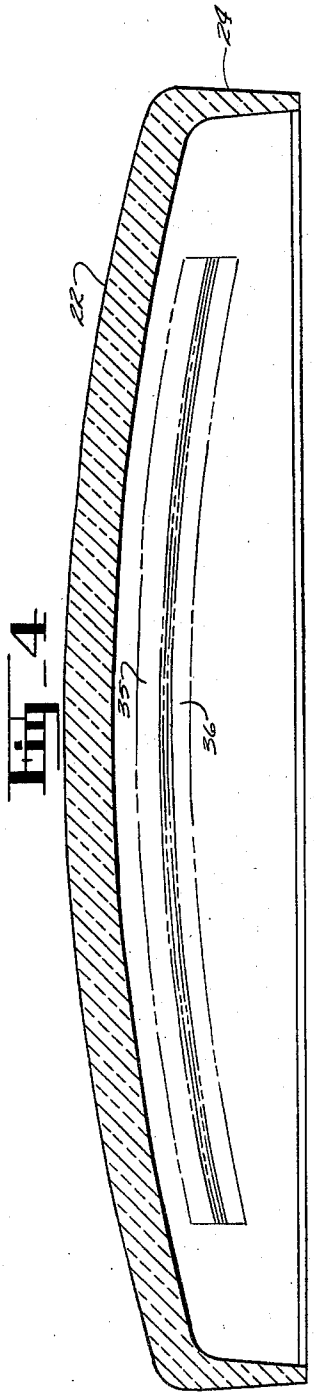

Fig. 7

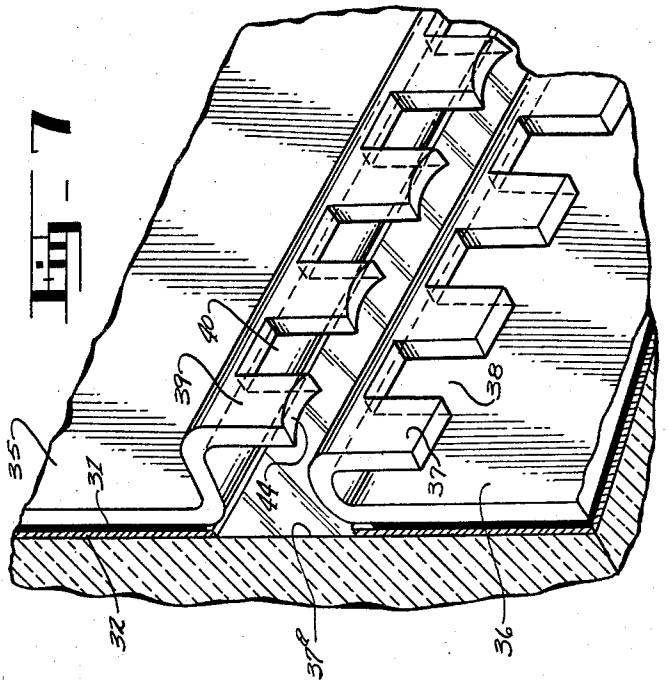

Fig. 6

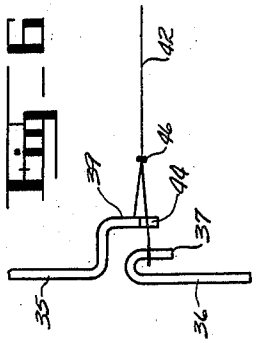

Fig. 5

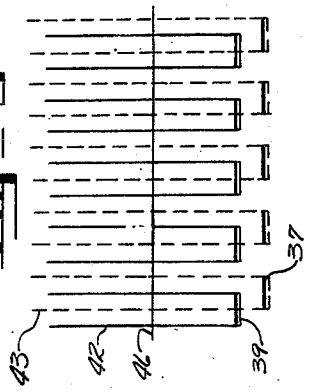

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Fig. 8

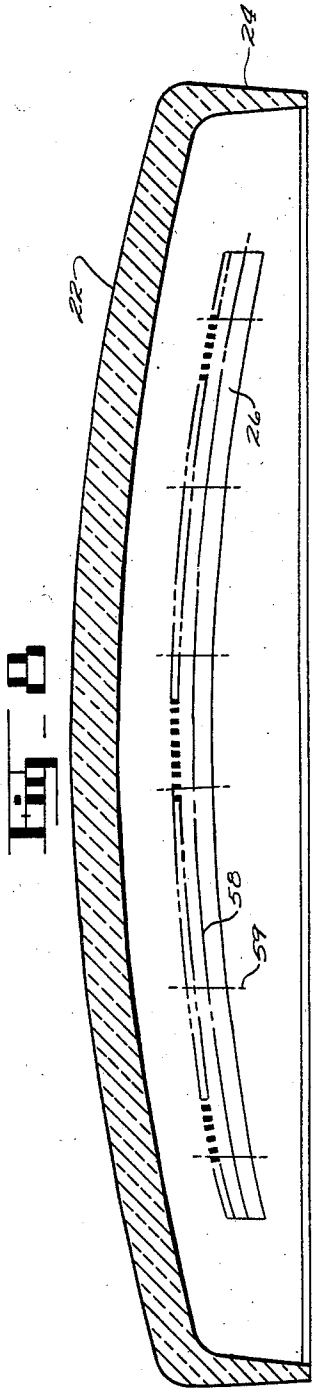

Fig. 11

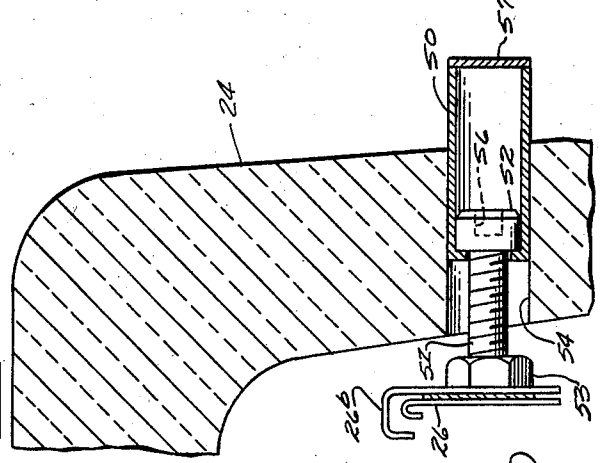

Fig. 10

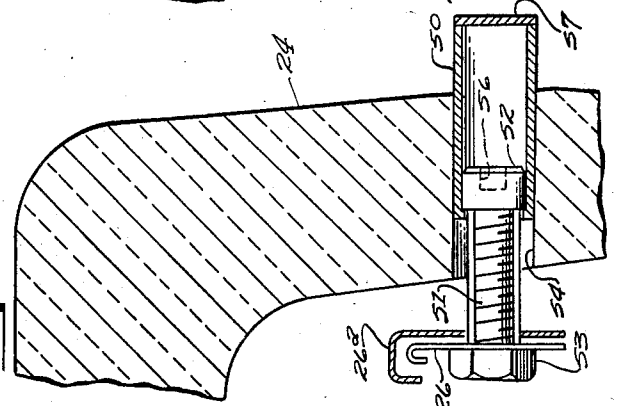

Fig. 9

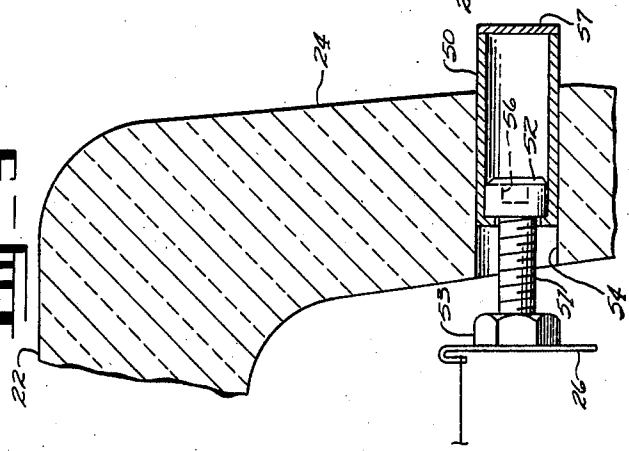

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Fig. 12

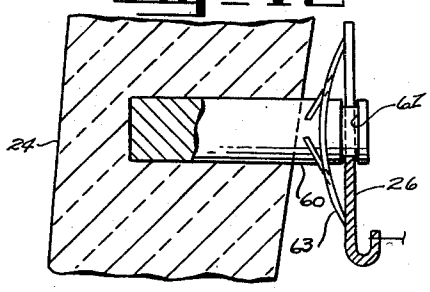


Fig. 13

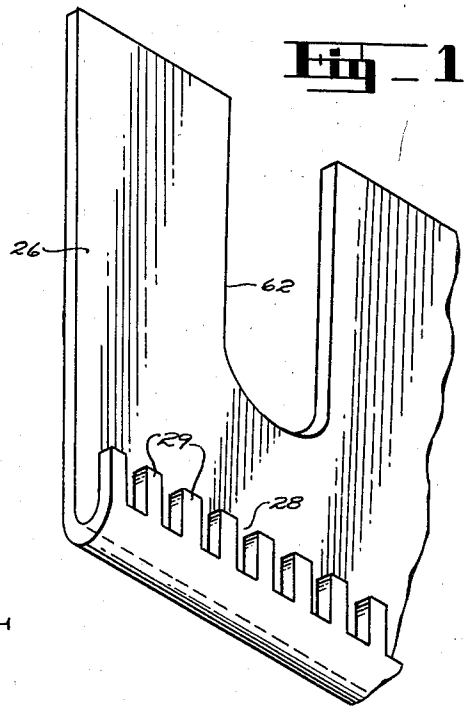


Fig. 14

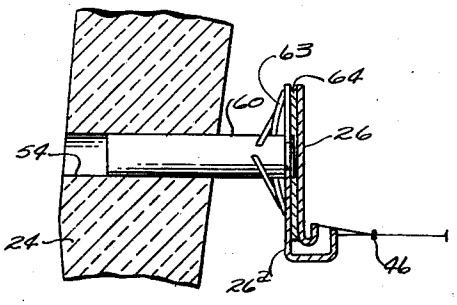


Fig. 16

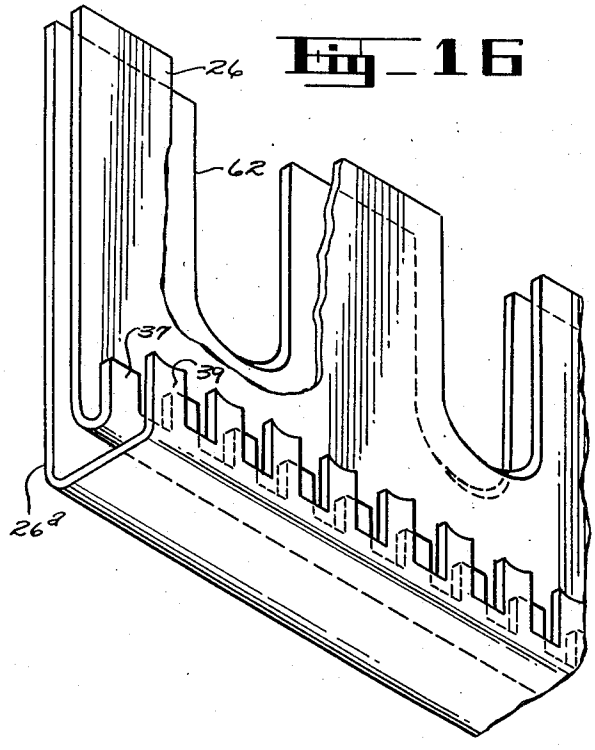
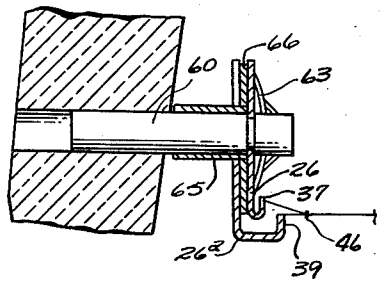


Fig. 15



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MOUNTINGS FOR PICTURE TUBE GRIDS

Kenneth M. Henry and Harvard B. Vincent, Toledo, Ohio, assignors to Owens-Illinois Glass Company, a corporation of Ohio

Application November 10, 1954, Serial No. 467,960

11 Claims. (Cl. 313—78)

Our invention relates to picture tubes. It provides new and improved means for mounting grids in cathode ray tubes and in certain forms thereof is particularly adapted for use in color television.

In picture tubes for color television as they are commonly constructed at the present day, the grid structure which controls the color registry is supported on a frame of substantial width which must be contained within the envelope, thereby making the area in which the picture may be produced substantially smaller than the face of the tube. If the width of the frame is decreased its stiffness becomes inadequate for end use.

An object of the present invention is to provide an improved construction by which the area available for the picture is increased to substantially the full area of the face plate of the picture tube.

The invention provides a construction in which relatively thin metal frame members or strips of sheet material are extended along the inner marginal surfaces of the face plate and bonded thereto. Such strips provide a frame or support for the fine wires forming the grid. Owing to the method of attachment of the strips to the envelope of the tube, they are of adequate stiffness to serve the requirements of end use and at the same time provide for a comparatively large picture area. For the purpose of attaching the grid wires to the supporting strips the latter may have an edge portion offset or bent to U-form and slotted to form rows of lugs or hooks for holding the grid wires or strands, the lugs and spacing slots being of a width corresponding to the required spacing of the grid wires.

In one form of our invention the grid supporting strips overlie and are adhered to the inner wall surfaces of the marginal flange of the face plate. In other forms the strips may be attached to the enclosing envelope by means of either solid or tubular studs sealed in the walls of the picture tube, the grid frame or strips being anchored to the studs.

The grids as mounted in the tubes or envelopes are used in combination with phosphor screens in a manner well-known in the art. The phosphor screen as used in color television may comprise lines, dots, or other form or pattern of sensitized surface. The screen may be mounted either on the grid structure or on the inner surface of the face plate.

Referring to the accompanying drawings:

Fig. 1 is a part sectional view of a picture tube embodying one form of our invention;

Fig. 2 is a section on a larger scale at the line 2—2 on Fig. 1;

Fig. 3 is a fragmentary perspective view showing a grid supporting strip mounted on the face plate of the tube;

Fig. 4 is a view similar to Fig. 2, showing a modified form of grid supporting strip;

Fig. 5 is a fragmentary diagrammatic plan view of the grid and supporting strips;

Fig. 6 is a diagrammatic view of the grid and supporting strips as seen in side elevation;

Fig. 7 is a fragmentary perspective view of the grid supporting strips shown in Figs. 4–6;

Fig. 8 is a view similar to Fig. 4 showing a further modification of the means for mounting the grid;

Figs. 9, 10, and 11 are fragmentary views illustrating various alternate means for attaching the grid supporting strips to the face plate;

Fig. 12 is a fragmentary view showing a further modification comprising a solid stud by which the grid frame is anchored to the face plate;

Fig. 13 is a fragmentary perspective view of a metal form or strip for carrying the grid;

Figs. 14 and 15 are fragmentary views similar to Fig. 12 showing further modifications of the grid mounting means; and

Fig. 16 is a view of a plural strip supporting frame for the grids.

Referring to Figs. 1, 2 and 3, which illustrate one form of our invention, the picture tube comprises a funnel-shaped body **20**, stem **21** and a face plate **22** made of glass and sealed to the body along the line **23**. The face plate may be of conventional, substantially rectangular, elongated form as viewed in plan. The face plate is convex and formed with a marginal flange **24** to which a grid is attached by means now to be described.

The grid comprises narrowly spaced fine parallel wires **25** attached to supporting strips or frame members **26** which preferably consist of thin metal. These strips **26** are mounted within the picture tube and extend along the longer or major sides of the face plate, being attached to the flange portion **24** as presently described. Each strip **26** has its upper marginal portion bent or curved inwardly in the form of an inverted U. Slots **28** divide this margin into a multiplicity of narrowly spaced lugs or hooks **29** which anchor the screen wires and hold them in narrowly spaced parallel relation.

The means for securing the strips **26** to the face plate includes a sheet or layer **31** of felt or the like cemented to the rear surface of the strip **26**. A sheet or layer **32** of suitable bonding material between the felt **31** and the face plate provides a means for securing the strip **26** to the face plate. The layer **32** may consist of a frit.

A further specific method of bonding the thin metal strips to the wall surface of the face plate consists in coating one or both of these parts, over suitable areas, with a brazing glass which melts and adheres at a temperature below the temperature at which distortion of the face plate becomes a serious problem. This brazing glass should be one which will not soften and permit the metal to pull away from the glass at a temperature of 750° F., to which temperature the assembly may be heated by the tube manufacturer during his processing. Brazing glass as herein referred to includes any compound of metallic oxides suitable for this purpose. Following the application of the brazing glass the face plate and the thin metal strips are assembled in a fixture which serves to locate and seat the metal strips as the assembly is heated in an oven to a temperature at which the brazing glass melts and adheres.

As a further modification of the strip attaching means, the inner face of the side wall or flange **24** may be metallized by the use of a silvery compound such as may be obtained on the open market. This area may then be electroplated and the grid supporting strip **26** attached thereto by soldering. A solder having a high softening point should be used to withstand the high temperature to which the tube is subjected during manufacturing or assembling operations. Such softening point should preferably be above 750° F.

Figs. 4–7 illustrate a modified construction for mounting two insulated grids in the face plate. These are adapted for use in tubes employing chromatic color design. In this construction upper and lower mounting strips **35** and **36** are attached to the inner face of the flange **24**. These strips are separated by a bare surface strip **37a** of the glass face plate which forms an insulating area. The grid frames **35** and **36** may be attached to the face plate in the same manner as above described in connection with Fig. 3, including the layers **31** and **32**. The lower grid frame or strip **36** may be substantially similar to the structure shown in Fig. 3, the upper portion of the strip being bent to U-form and comprising downwardly extending lugs or hooks **37** spaced apart by slots **38**. The upper grid plate **35** has its lower portion offset inwardly and is slotted to provide downwardly extending lugs or hooks **39** spaced apart by slots **40**. As shown diagrammatically in Fig. 5, the upper lugs **39** may be offset laterally with respect to the lower lugs **37** so that the wires **42** forming one of the grids alternate with the wire **43** (shown in broken lines) forming the other grid, the alternate wires being equally spaced apart. The lower ends of the upper lugs **39** are formed with upwardly curved surfaces **44** which may assist in holding the wires **43** in the uniformly spaced position between the wires **42**. The two grids or sets of wires **42**, **43** are held in the same plane or at a common level by the interwoven wires or strands **46** of glass or other insulating material.

The grid wires are narrowly spaced. For example, they may have a spacing of .030″. The screen plate behind them (not shown) is provided, for example, with stripes of phosphor .015″ wide fluorescing in the colors in the usual sequence, red, green, blue, green, red.

Figs. 9, 10 and 11 illustrate various alternate structures for attaching the grid supporting strips to the face plate. Referring particularly to Fig. 9, a cylindrical metal tube **50** is mounted in the flange portion **24** of the face plate, a bolt **51** extends through a restricted opening in the inner end of the cylinder **50**, the head **52** of the bolt being within the cylinder and bearing against the end wall of the cylinder. The bolt has a screw-threaded connection with the strip **26**. This may comprise a nut **53** welded to the strip and in which the bolt is threaded. The cylinder **50** is mounted within a cylindrical opening **54** extending through the wall of the face plate. The cylinder is preferably attached by fusion to the wall surface of the opening **54**. The screw head is provided with a kerf **56** to receive a tool extended through the open cylinder for attaching and adjusting the bolt to the nut **53**. Following the installation of the grid the outer end of the cylinder is closed by a disk **57** which is soldered in place. The solder should have a softening point, preferably higher than 750° F. which is the usual baking temperature at which the assembly will be heated by the tube maker during processing. A plurality of these tube assemblies are used for the attachment of each of the strips **26**. These attachments may be located at intervals lengthwise of the strip as indicated diagrammatically on Fig. 8, at the intersecting points of the broken line **58** extending lengthwise of the strip and the cross lines **59**.

Fig. 10 illustrates a modification of the structure shown in Fig. 9, adapted for use with two grids such as heretofore described in connection with Figs. 4–7. In this structure the nut **53** is attached to the front face of the strip **26**. A second strip **26a** is mounted behind the strip **26** for attachment of the wires forming the second grid. The strip **26a** may be made of insulating material.

In Fig. 11 a grid supporting strip **26b** is welded or brazed to the front face of the nut **53** and insulated from the strip **26**. In each of the structures shown in Figs. 9, 10 and 11, the bolt serves as a tension and take-up means between the tubes and strips **26** for applying tension to the grid wires.

Figs. 12–16 illustrate further modified constructions in which solid, cylindrical metal studs **60** are employed for attaching the grid frames or strips to the face plate. The studs **60** consist of a metal matching the glass for expansion characteristics, the studs being soldered by fusion at suitable intervals along the two opposite sides of the face plate **26**. As shown in Fig. 12 the opening in which the stud is mounted extends only part way through the glass wall. Each stud is formed adjacent to its exposed end with a groove **61**. The strip **26** is formed with slots **62** to receive the studs **60**, with the side walls of the slots in the grooves **61**. The slots are spaced to correspond with the spacing of the studs. Slotted spring washers **63** are mounted on the strips **26** and serve to hold the strips in position on the studs.

Fig. 14 illustrates a mounting for plural grids. Such mounting includes the strips **26** and **26a**. In this construction the slots are formed in the strip **26a** for attaching the assembled strips to the studs **60**. The strips **26** and **26a** may be spaced apart and insulated from each other by an interposed strip **64** of insulating material. As shown in Fig. 14 the face plate is formed with openings **54** extending entirely through the glass wall.

Figs. 15 and 16 illustrate a mounting for plural grids in which the strips **26** and **26a** are both formed with slots permitting them to be mounted on the studs **60**. In this structure the strip **26a** is positioned behind the strip **26**, that is, interposed between the strip **26** and the glass wall. A sleeve **65** of insulating material is mounted on the stud **60**. Insulating strips or washers **66** may be interposed between the strips **26** and **26a**. The spring washers **63** in this form of mounting are positioned in front of the grid supporting strips. The lugs **37** and **39** on the strips **26** and **26a** may be arranged in staggered relation as above described in connection with Figs. 5–7.

Modifications may be resorted to within the spirit and scope of our invention.

We claim:

1. A picture tube comprising an envelope, a grid therein and means for attaching the grid to the walls of the envelope, the attaching means comprising strips of thin sheet material extending along the said walls with a major portion of each strip lying flat against the side walls, and means for anchoring said strips to said walls, the grid comprising a multiplicity of narrowly spaced fine strands anchored to said strips, the said major portions of said strips being substantially perpendicular to the grid strands.

2. The picture tube defined in claim 1, the said attaching strips each having a marginal portion thereof offset and slotted to form a multiplicity of spaced lugs in a row extending lengthwise of the strip and by which the grid strands are held.

3. The picture tube defined in claim 2, the said marginal portions of the strips being bent to substantially U-form, the said lugs and slots being of approximately equal width and holding the said grid strands narrowly and equally spaced.

4. The picture tube defined in claim 1, the envelope consisting of glass, the said strips consisting of sheet metal, and a layer of bonding material interposed between the said strips and the wall surfaces of the envelope and forming a bond between said strips and envelope.

5. The apparatus defined in claim 4, said bonding material comprising a frit.

6. The combination set forth in claim 1, the said strips consisting of metal welded to the inner wall surfaces of the envelope.

7. A picture tube comprising a body and a face plate formed with a peripheral flange, a grid mounted within the tube, means for attaching the grid to the face plate comprising sheet metal strips extending lengthwise along opposite wall surfaces of said flange, means for anchoring said strips to said flange, each said strip having a marginal portion extending lengthwise thereof and offset inwardly from the body of the strip, the said body of the strip lying flat against the flange throughout its area, said

offset portion being slotted to form a multiplicity of lugs with interposed spaces substantially equal in width to the lugs, the grid comprising a multiplicity of fine wires anchored to said lugs.

8. A picture tube comprising an envelope, grids mounted therein, each grid comprising a multiplicity of parallel strands, means for attaching the grids to the walls of the picture tube, said attaching means comprising pairs of parallel strips of sheet metal extending along and parallel with inner wall surfaces of the envelope, the strands forming one of said grids being attached to one pair of said strips, the strands forming the other grid being attached to another pair of said strips, each of the strips being formed with a multiplicity of narrow, narrowly spaced lugs to which the grid strands are anchored and by which the strands are held uniformly and narrowly spaced apart, and means for holding the strands of the two grids in the same plane, said plane being perpendicular to the body portions of said strips.

9. The apparatus defined in claim 8, the said lugs on one pair of said strips being in staggered relation to the lugs on the other pair of strips, the strands of one grid alternating with those of the other.

10. The apparatus defined in claim 8, the said attaching strips being in parallel relation to the adjoining surfaces of the envelope and a layer of bonding material between each strip and the envelope by which said strips are bonded and rigidly adhered to the wall of the envelope.

11. The apparatus defined in claim 8, the said walls of the envelope consisting of glass, the said strips consisting of metal, the strips to which the strands of one grid are attached lying substantially in the same plane as the corresponding strips to which the strands of the other grid are attached, the said strips being spaced apart with an interposed bare strip surface of the glass envelope insulating the strips of one grid from those of the other.

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