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CATHODE RAY TUBE APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a Cathode ray tube (CRT) apparatus with an explosion-protection band of the type comprised of a band body to be attached to the outer periphery of the panel portion of the CRT and CRT holders which are attached by resistance welding to the band body.

2. Description of the Related Art

Figure 1 shows the related art of CRT.

A CRT 10, as shown in Fig. 1, comprises a panel portion 1 on which a picture is displayed and a funnel portion 2. These are fused together by frit glass (solder glass). To establish a high degree of vacuum in the CRT 10, the air is drawn out from the neck portion 3 of the funnel portion 2. To prevent the deformation of the front of the panel portion 1 and protect the panel portion 1 at the time of creating the vacuum, a CRT explosion-protection band 5 is attached to the panel portion 1.

The CRT explosion-protection band 5, as shown in Fig. 2, is comprised of a band body 6 which is wound around the circumference of the panel portion 1. This band body 6 is made by bending a steel material into a rectangular shape. The two end portions 6a, 6b of the band body 6 are

connected to each other through a plate 7a.

A CRT 10, however, is designed to be affixed to a casing or frame etc. through the CRT holders 8. Figure 1 and Fig. 2 show an explosion-protection band 5 of a type with CRT holders 8 attached to the four corners of the band body 6.

The CRT holders 8 and the plate 7a are attached to the band body 6 by resistance welding. Resistance welding, as is well known, is a technique in which a current is passed at the location where members are to be joined so as to raise the temperature of the join portion by the resistance heat generated by the current and then applying pressure. This type of resistance welding includes "projection welding" in which projections are formed at one of the locations to be welded. With projection welding, there are the advantages that it is possible to concentrate the current at the projections and thereby increase the weld strength and several points can be welded at the same time.

Even with the CRT explosion-protection band 5, sufficient mounting strength is demanded of the CRT holders 8 and plate 7a, so the CRT holders 8 etc. are attached to the band body 6 by projection welding.

With the conventional explosion-protection band 5, however, since projections for projection welding were formed at the CRT holder 8 side, as shown in Fig. 2, there were burrs or other bumps resulting from the nuggets 7

caused by the welding at the inside of the band body 6 after welding, that is, at the side facing the panel portion 1. Normally, a band body 6 has a thickness of approximately 1 mm. As opposed to this, a holder 8 has a thickness of about 2 mm. Therefore, bumps have tended to form at the inside of the thin band body 6 due to the nuggets 7 formed by the welding. Further, in normal resistance welding, the practice has been to form the resistance welding projections at the thick plate side.

Due to the occurrence of burrs and bumps caused by the resistance welding, when the band body 6 has been wound around the panel portion 1, there was the danger of the panel portion 1 being scratched etc. and therefore the explosion-protection performance being deteriorated.

1. Further, when the outer circumference of a CRT is scratched etc. due to burrs or bumps of the explosion-protection band 5, it has been difficult to reuse the panel portion 1 after attachment of an explosion-protection band 5.

Further, since bumps are formed at the inside of the band body 6 due to the nuggets 7, it has been difficult to maintain the welding electrodes and increase the life of the welding electrodes.

Note that the plate 7a is also attached to the band body 6 by projection welding, but this portion does not

press against the outer circumference of the panel glass, so there is none of the problem explained above. The portions where burrs and bumps caused by projection welding are likely to scratch the outer circumference of the panel portion 1 are the portions where the CRT holders 8 are attached.

OBJECT AND SUMMARY OF THE INVENTION

The present invention was made in consideration of this situation and has as its object to provide a CRT apparatus with a CRT explosion-protection band to be attached to the outer circumference of the panel portion of a CRT and which has a superior explosion-protection performance. In accordance with the invention, a CRT apparatus is claimed in claim 1 and an apparatus is claimed in claim 2.

To achieve the above object, according to one aspect, there is provided a cathode ray tube apparatus comprising:

- a cathode ray tube;

- a band body being wound around the circumference of a panel portion of the cathode ray tube; and

- a cathode ray tube holder for affixing said cathode ray tube to a mounting; wherein

- a portion of the band body to which said cathode ray tube holder is to be attached protrudes outward so that a clearance is formed with the outer bend of said cathode ray tube; and

- the height of the protrusion of the portion of the band body protruding outward is 0.1 to 0.5 mm.

According to another aspect, there is provided apparatus for use with a cathode ray tube comprising:

- a band body to be wound around the circumference of a panel portion of a cathode ray tube, and

- at least one cathode ray tube holder for affixing to said band body, for use in mounting said band; wherein

a portion of the band body to which the or each cathode ray tube holder is to be attached protrudes outwards relative to other portions of the band at that lengthwise position on the band, so that a clearance can be formed with an outer bend of a cathode ray tube about which the band is wound; and

the height of the protrusion of the portion of the band body protruding outwards is 0.1 to 0.5 mm.

Advantageously, the or each cathode ray tube holder lacks a recess corresponding to the protrusion.

The band may have three such protrusions forming a triangle where the or each cathode ray tube holder is to be attached.

Alternatively, the protruding portion of the band body is at a position corresponding to a corner of a cathode ray tube when wound therearound and comprises a section having a lengthwise extent corresponding to said corner and a widthwise extent, extending partially across said band, starting at one edge.

Thus, even if the CRT holders are attached to the band body by resistance welding, there will not be burrs or other bumps at the inside of the band body, that is, at the side facing the panel portion. Accordingly, when the band body is wound around the panel portion, the panel portion of the CRT will not be scratched etc. and thereby the explosion-protection performance can be maintained or improved.

Further, according to the CRT explosion-protection band of the present invention, where the band body is made to protrude outward from the CRT at the portions where the CRT holders are to be attached, there is the following action.

In the CRT explosion-protection band according to this aspect, even if resistance welding projections are provided at the CRT holder side and the CRT holders are resistance welded to the band body, burrs or other bumps at the inside of the band body, that is, at the side facing the panel portion, will be contained in the portions where the band body is made to protrude. Accordingly, when winding the band body around the panel portion, the burrs or bumps will not press against the panel portion. As a result, the panel portion will not be scratched etc. and the explosion-protection performance can be maintained or improved.

The resistance welding projections typically have a diameter of 5.0 ± 1.0 mm and might normally give the predetermined welding strength if two or four are formed.

Further, when pawls for holding stacked band bodies are formed at the CRT holders, it is possible to stack fabricated CRT explosion-protection bands, thereby making storage easy.

Further, if the dimension of the protrusions of the band body is made 0.1 to 0.5 mm, it is possible to reliably contain burrs and other bumps at the inside of the band body.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and features of the present invention

will be described in detail with reference to accompanying drawings, in which

Fig. 1 is a perspective view showing a CRT with a CRT explosion-protection band of related art attached to a panel portion,

Fig. 2 is a disassembled perspective view of a conventional CRT explosion-protection band,

Fig. 3 is a perspective view showing a CRT explosion-protection band according to an embodiment of the present invention along with a CRT,

Fig. 4 is a disassembled perspective view of a CRT explosion-protection band according to the same embodiment,

Fig. 5 is a perspective view of a CRT holder in the CRT explosion-protection band according to the same embodiment,

Fig. 6 is an enlarged perspective view of key portions where the projections of the band body are formed in a CRT explosion-protection band according to the same embodiment,

Fig. 7 is an enlarged perspective view of key portions where a CRT holder is attached to a band body by resistance welding in a CRT explosion-protection band according to the same embodiment,

Fig. 8 is a cross-sectional view along line VI-VI of Fig. 7,

Fig. 9 is a cross-sectional view of key portions showing the state of attachment of the CRT explosion-

protection band according to the same embodiment to the panel portion of a CRT,

Fig. 10 is a perspective view of a CRT holder in a CRT explosion-protection band according to a second embodiment of the present invention,

Fig. 11 is an enlarged perspective view of key portions of a band body in a CRT explosion-protection band according to the same embodiment,

Fig. 12 is an enlarged perspective view of key portions where a CRT holder is attached to a band body by resistance welding in a CRT explosion-protection band according to the same embodiment,

Fig. 13 is a cross-sectional view along line XIII-XIII in Fig. 12.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Below, the CRT explosion-protection band according to the present invention will be explained in more detail referring to the illustrated embodiments.

As shown in Fig. 3, a CRT explosion-protection band 30 according to an embodiment of the present invention is comprised of a band body 31 to be wound around the circumference of the panel portion 21 of the CRT 20 and CRT holders 32 for affixing the CRT 20 to a casing or frame (see Fig. 8) etc. serving as the mounting 33. Note that in the following explanation, the CRT sides of the members making

up the CRT explosion-protection band 30 are referred to as the insides of the members and the opposite sides are referred to as the outsides.

The band body 31, as shown in Fig. 4 as well, is made by bending a steel material into a rectangular shape. The two ends 31a, 31b of the band body 31 are connected to each other through a plate 34. Further, as shown in Fig. 8, the bottom edge of the band body 31 in the figure is bent outward to form a fold so as to raise its strength. This bent portion 35 is formed by hemming by a press or by a roll former over several stages.

The steel material for forming the band body 31 is not particularly limited, but may for example be a zinc coated steel material, aluminum plated steel material, or nickel plated steel material. Further, when forming the band body 31 by press forming, use is made for example of a steel material having a thickness of 1.4 to 2.0 mm or so. When forming a band body 31 with a bent portion 35 by a roll former, use is made for example of a steel material having a thickness of 0.8 to 1.2 mm.

The plate 34, as shown in Fig. 4 as well, is attached so as to cover the two ends 31a, 31b of the band body 31. Part of the plate 34 projects outward somewhat corresponding to the bent portion 35 formed at the band body 31.

The CRT holders 32, as shown in Fig. 4 as well, are

formed by performing bending, piercing, and other press forming work on a steel material and are attached to the four corner portions 36 of the band body 31. Each CRT holder 32, as shown in Fig. 5, Fig. 7, and Fig. 8, has an approximately L-shaped cross-section and is comprised of a base portion 37a to be attached to the band body 32 and a plate-shaped flange portion 38 extending from the base portion 37a to the outside. The base portion 37a has a round shape corresponding to the round shape of the corner portions 36 of the band body 31. The flange portion 38 is formed with a through hole 39 through which a screw, a bolt, or another suitable fastening means can be inserted. As shown in Fig. 8, by fastening the flange portions 38 through the fastening means to the casing 33 etc. serving as the mounting, the CRT 20 is affixed to the casing 33.

Pawls 40 are formed at the top end of the band body 37a in the figure. Due to the pawls 40, it becomes possible to stack CRT explosion-protection bands 30 which have been fabricated. The band bodies 31 of the stacked CRT explosion-protection bands 30 are designed to be held by the pawls 40. As shown in Fig. 8, the pawls 40 project somewhat to the outside so as to accommodate the bent portion 35 formed at the band body 31.

The steel material forming the CRT holders 32 and the plate 34 is not particularly limited, but a steel material

similar to the band body 31 is used. Further, a steel material having a thickness similar to the band body 31 is used.

The CRT holders 32 are attached to the band body 31 by resistance welding, particularly projection welding. When performing projection welding, it is necessary to form projections at one of the CRT holder 32 or band body 31.

In conventional resistance welding, the projections were formed at the thicker member, but in the present embodiment, as shown enlarged in Fig. 6, the projections 41 for CRT holders for use in projection welding are provided at the four corner portions 36 of the relatively thin band body 31.

The projections 41 project toward the outside from the inside of the band body 31 and are formed by press forming. The dimensions of the projections 41 are, for an explosion-protection band 30 for a 20 to 30 inch CRT, a diameter of 5.0 ± 1.0 mm and a height of 0.5 to 1.0 mm.

The number of the projections 41 formed for projection welding a single CRT holder 32 is not particularly limited, but preferably two to four projections 41 are formed. When, as shown in the illustrated examples, the corner portions 36 of the band body 31 or the base portions 37 of the CRT holders 32 have a round shape, if four projections 41 are formed, even if welding is performed with pressure applied,

one of the points may not contact the CRT holder 32 and therefore a poor join may result. Therefore, in such a case, it is preferable to form three projections 41. Further, at this time, the three projections 41 are preferably arranged in a triangular configuration with one projection 41 being positioned at the ridge-line of the corner portion 36 and the other two projections 41 positioned at the two adjoining surfaces separated by the ridge-line. By arranging them in this way, the mounting strength of the CRT holders 32 becomes equal along the direction perpendicular to the ridge-line and the two directions perpendicular to the sides, that is, a total of three directions.

The plate 34 is also attached to the band body 31 by resistance welding, in particular by projection welding. The projections 42 for the plate for use in the projection welding are provided at the inside surface of the plate 34.

The projections 42 project toward the inside from the outside of the plate 34 and are formed by press forming. The dimensions of the projections 42 are substantially the same as the dimensions of the projections 41 for the CRT holders. Further, the number of the projections 42 formed is not particularly limited, but a predetermined number for enabling suitable connection of the two ends 31a, 31b of the band body 31 are formed.

In the explosion-protection band 30 of the present

embodiment, as shown in Fig. 8, the projections 31 for the CRT holders are provided at the band body 31 side, so even if the CRT holders 32 are attached to the band body 31 by projection welding, burrs and other bumps will never project out at the inside of the band body 31, that is, the side facing the panel body 21. As shown in Fig. 8, the nuggets 37 caused by the resistance welding are formed at the interface of the band body 31 and the CRT holders 32. Due to these nuggets 37, in the past, as shown in Fig. 2, there had been a chance of projections being formed at the inside of the band body 6. In the present embodiment, the resistance welding projections 41 are formed at the band body 31 side facing outward, so concavities 41a caused by the formation of the projections 41 are formed at the inside of the band body 31. The bumps caused by the nuggets 37 are contained in these concavities 41a. Accordingly, burrs or bumps never project out from the inside abutting face 31a of the band body 31.

Further, the welding strength of the CRT holders 32 and band body 31 in this embodiment was measured and found to be over 600 kgf, whereby it was confirmed that there was no problem at all with strength.

Note that the plate 34 is also attached to the band body 31 by projection welding, but this portion is not one which presses against the outer circumference of the CRT glass, so

there is no problem even if the resistance welding projections are formed at the plate 34 side.

In this embodiment, as shown in Fig. 9, when the band body 31 is wound around the panel portion 51, the panel 51 will no longer be scratched etc. and the explosion-protection performance can be maintained or improved. It was confirmed that there were no scratches when actually attaching the CRT explosion-protection band of the present embodiment to a panel portion 51 of a CRT.

Further, since there are no scratches on the CRT even after attachment of the explosion-protection band 30, it becomes possible to reuse the CRT 20.

Further, since there are no longer projections or burrs at the electrode side of the welds abutting against the electrode, it becomes easier to maintain the welding electrodes and thereby increase the life of the welding electrodes.

Note that in the present invention, the projections 42 for the plate may be formed at the band body 31 in the same way as the projections 41 for the CRT holders. Further, by overlapping the two ends 31a, 31b of the band body 31 and then joining them by resistance welding, there is no longer a need for use of the plate 34. At this time, projections for projection welding are formed at the end portion positioned at the outside among the two overlapping ends 31a, 31b of the

band body 31.

Figure 10 to Fig. 13 show a CRT explosion-protection band according to a second embodiment of the present invention, wherein Fig. 10 is a perspective view of a CRT holder in a CRT explosion-protection band in the embodiment; Fig. 11 is an enlarged perspective view of key portions of a band body in a CRT explosion-protection band according to the same embodiment; Fig. 12 is an enlarged perspective view of key portions where a CRT holder is attached to a band body by resistance welding in a CRT explosion-protection band according to the same embodiment; and Fig. 13 is a cross-sectional view along line XIII-XIII in Fig. 12.

The CRT explosion-protection band according to this other embodiment of the present invention differs from the explosion-protection band 30 of the previously explained embodiment on the point of provision of the projections for the CRT holders for use in projection welding at the CRT holders and the point of the change of shape of the band body at the portions where the CRT holders are to be attached. The explanation will be made below focusing on these points.

The CRT explosion-protection band 45, as shown in Fig. 12, is comprised of a band body 46 to be wound around the circumference of the panel portion 51 of the CRT 20 and CRT holders 47 attached to the four corner portions 36 of the band body 46.

The CRT holders 47, in the same way as the CRT holders 32 of the previously explained embodiment and as shown in Fig. 10, Fig. 12, and Fig. 13, have an L-shaped cross-section and are comprised of a base portion 37a, flange portion 38, and pawl 40. In this embodiment, as shown in Fig. 10, projections 48 for CRT holders for use in projection welding are provided at the base portions 37a of the CRT holders 47.

The projections 48 project toward the inside from the outside of the base portion 37a and are formed by press forming. The dimensions of the projections are, for an explosion-protection band 45 for a 20 to 30 inch CRT, a diameter of 5.0 ± 1.0 mm and a height of 0.5 to 1.0 mm.

The number of the projections 48 formed for projection welding a single CRT holder 47 is not particularly limited, but preferably two to four projections 48 are formed. When, as shown in the illustrated examples, the corner portions 36 of the band body 46 or the base portions 37a of the CRT holders 47 have a round shape, as explained above, it is preferable to form three projections 48. Further, at this time, as explained above, the three projections 48 are preferably arranged in a triangular configuration.

On the other hand, the band body 46, as shown enlarged in Fig. 11, protrudes toward the outside and thereby is formed with depressions 49 at the inside at the portions

where the CRT holders 47 are to be attached, that is, the four corner portions 36. Due to the depressions 49, when the band body 41 is attached to the panel portion 51, a predetermined clearance is formed between the panel portion 51 and the band body 46. The dimension of the protrusion of the band body 41, that is, the dimension of the clearance, is preferably 0.1 to 0.5 mm or so.

In the explosion-protection band 45 of the embodiment of this configuration, the projections 48 for projection welding are provided at the CRT holder 47 side, but depressions 49 are formed at the inside of the band body 46, so even if the CRT holders 47 are attached to the band body 46 by projection welding, the burrs and other bumps formed facing the inside of the band body 46 are contained in the depressions 49.

Accordingly, in the same way as the previously explained embodiment, when the band body 46 is wound around the panel portion 51, the panel 51 will no longer be scratched etc. and the explosion-protection performance can be maintained or improved. Further, it becomes possible to reuse the panel portion 51. Also, the maintenance of the welding electrodes becomes easier and therefore the life of the welding electrodes can be prolonged.

Note that the positions of attachment of the CRT holders 32, 47 to the band bodies 31, 46 are not limited to

the four corner portions 36 of the band bodies 31, 46 illustrated and may be portions other than the corner portions 36. Further, the shapes and numbers of the CRT holders 32, 47 are not limited to the shapes and numbers of the illustrated examples and may be suitably changed in accordance with the positions of attachment to the band bodies 31, 46, the relative positional relationship with the mounting, etc.

As explained above, according to the CRT explosion-protection band of the present invention, projections for resistance welding are formed at the band body side, so even if the CRT holders are attached to the band body by resistance welding, there will never be burrs or other bumps at the inside of the band body, that is, the side facing the panel portion. Accordingly, when the band body is wound around the panel portion, the panel portion of the CRT will not be scratched etc. and thereby the explosion-protection performance can be maintained or improved. Further, it becomes possible to reuse the panel portion. In addition, maintenance of the welding electrodes becomes easier and therefore the life of the welding electrodes can be increased.

Further, according to the CRT explosion-protection band according to another aspect of the present invention, the band body is made to protrude outward from the CRT at the

portions where the CRT holders are to be attached, so even if the CRT holders are attached to the band body by resistance welding using resistance welding projections formed at the CRT side, burrs or other bumps at the inside of the band body, that is, the side facing the panel portion, will be contained in the portions where the band body is made to protrude. Accordingly, when winding the band body around the panel portion, the CRT panel portion will not be scratched etc. and the explosion-protection performance can be maintained or improved. Further, it becomes possible to reuse the panel portion. In addition, maintenance of the welding electrodes becomes easier and therefore the life of the welding electrodes can be made longer.

Further, since pawls for holding stacked band bodies are formed at the CRT holders, it is possible to stack fabricated CRT explosion-protection bands, thereby making storage easy.

CLAIMS:

1. A cathode ray tube apparatus comprising:
 - a cathode ray tube;
 - a band body being wound around the circumference of a panel portion of the cathode ray tube; and
 - a cathode ray tube holder for affixing said cathode ray tube to a mounting; wherein a portion of the band body to which said cathode ray tube holder is to be attached protrudes outward so that a clearance is formed with the outer bend of said cathode ray tube, and wherein the protruding portion of the band body comprises a section extending partially across said band, starting at one edge.
2. Apparatus for use with a cathode ray tube comprising:
 - a band body to be wound around the circumference of a panel portion of a cathode ray tube; and
 - at least one cathode ray tube holder for affixing to said band body, for use in mounting said band, wherein a portion of the band body to which the or each cathode ray tube holder is to be attached protrudes outwards relative to other portions of the band at that lengthwise position on the band, so that a clearance can be formed with an outer bend of a cathode ray tube about which the band is wound, and wherein the protruding portion of the band body

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comprises a section extending partially across said band, starting at one edge.

3. Apparatus according to claim 1 or 2, wherein the or each cathode ray tube holder lacks a recess corresponding to the protrusion.
4. Apparatus according to claim 1, 2, or 3, wherein the height of the protrusion of the portion of the band body protruding outward is 0.1 to 0.5 mm.
5. Apparatus according to any preceding claim wherein the protruding portion of the band body is at a position corresponding to a corner of a cathode ray tube when wound there around and comprises a section having a lengthwise extend corresponding to said corner and a widthwise extend, extending partially across said band, starting at one edge.
6. Apparatus according to any preceding claim wherein the cathode ray tube holder is provided with pawls for holding stacked band bodies.