

CATHODE RAY TUBE, INTERNAL MAGNETIC SHIELD
AND METHOD OF MANUFACTURING SAME

5 BACKGROUND OF THE INVENTION

1. Field of the invention

The present invention relates to a cathode ray tube (CRT) of a color television set etc., more particularly to an internal magnetic shield provided integrally with an internal beam shield for use in a CRT and to a method of manufacturing the same.

2. Description of the Related Art

A color CRT is provided internally with an internal magnetic shield (IMS) for shielding from terrestrial magnetism and an internal beam shield (IBS) for shielding from unnecessary electron beams outside of an effective screen of the CRT or for preventing the unnecessary electron beams from striking the frame of a shadow mask and reflecting to the effective screen.

20 Conventional CRT's include ones having an IMS and an IBS attached individually and ones having an IMS which also functions as an IBS.

However, there is the disadvantage that the cost of the CRT's having the IMS and the IBS attached individually is high.

Also there is the disadvantage that the CRT's having an IMS which also functions as an IBS is complex in manufacturing process and poor in work efficiency of manufacture.

5 Further, there is the disadvantage that the stacking efficiency of the IMS's is low.

SUMMARY OF THE INVENTION

 An object of the present invention is to provide an
10 improved internal magnetic shield which enables lower costs and good stacking efficiency.

 Another object of the present invention is to provide an improved cathode ray tube using such an internal magnetic shield.

15 Still another object of the present invention is to provide an improved method of manufacturing an internal magnetic shield which enables good work efficiency.

 To achieve the above object, the inventor of the present invention found that when using an internal
20 magnetic shielding means comprised of a first piece and a second piece positioned approximately symmetric about a center line of a lengthwise direction, the characteristic of the IMS will be the same or better than the conventional case of using an internal magnetic shielding
25 means comprised of the first piece and second piece plus a

third piece and a fourth piece positioned approximately symmetric about a center line of a widthwise direction.

Further, by configuring the internal magnetic shielding means in this way, it becomes possible to form the internal magnetic shielding means and an internal beam shielding means in one piece without welding, calking, etc. by cutting and bending a single sheet and it is possible to achieve lower cost and improved work efficiency.

Further, forming the internal magnetic shielding means and internal beam shielding means so as not to overlap in the front direction enables improvement of the stacking efficiency.

That is, the cathode ray tube according to a first aspect of the present invention is comprised of a faceplate panel; a funnel joined along a sidewall of the panel; and an internal magnetic shield positioned in the funnel and having a pair of long pieces positioned symmetrically about a horizontal axis of an effective screen on the panel and a pair of short pieces positioned parallel with a vertical axis of an effective screen on the panel, wherein the pair of long pieces and the pair of short pieces is formed in one piece by folding a sheet of metal. Further the cathode ray tube according to the present invention is comprised of a faceplate panel; a

funnel joined along a sidewall of the panel; and an internal magnetic shield comprising an internal magnetic shielding means having a first piece and a second piece located approximately symmetric about a center line parallel to a lengthwise direction for shielding from the effects of a magnetic field in a cathode-ray tube and an internal beam shielding means, positioned perpendicular with the first piece and the second piece and approximately symmetric about a center line parallel to a widthwise direction, for shielding from unnecessary beams outside of an effective screen, wherein the internal magnetic shielding means and the internal beam shielding means are formed by partially cutting and bending a single sheet.

Further, in the internal magnetic shield of the present invention, preferably the internal magnetic shielding means further has a third piece and a fourth piece for engaging with the first piece and the second piece and positioned approximately symmetric about a center line parallel to a widthwise direction. The further provision of the third piece and the fourth piece in this way enables improvement of the characteristics as an IMS.

Further, in the internal magnetic shield of the present invention, preferably there are engaging portions for providing a gap between adjacent internal magnetic

shields when stacking a plurality of the internal magnetic shields and wherein the internal beam shielding means positioned so as not to overlap with the internal magnetic shielding means in the front direction.

5 Provision of the engaging portions in this way enables close contact of the adjoining internal magnetic shields with each other when stacking a plurality of internal magnetic shields to be avoided and facilitates removal of the internal magnetic shields.

10 Further, in the internal magnetic shield of the present invention, preferably the first piece and the second piece of the internal beam shielding means are formed with their front ends bent toward the electron gun side.

15 Further, in the internal magnetic shield of the present invention, preferably the internal beam shielding means are formed with their front ends bent twice.

 By bending the front ends twice in this way, it is possible to effectively avoid electron beams in the
20 cathode ray tube from striking the internal beam shield and being output toward the aperture grille. Provision of the engaging portions in this way enables close contact of the adjoining internal magnetic shields with each other when stacking a plurality of internal magnetic shields to
25 be avoided and facilitates removal of the internal

magnetic shields.

Further, the method of manufacturing an internal magnetic shield according to a third aspect of the present invention includes preparing a single sheet; first
5 partially cutting the sheet to form the internal magnetic shielding means; second partially cutting the sheet to form the internal beam shielding means; first partially bending the sheet to form the internal magnetic shielding means; and second partially bending the sheet to form the
10 internal beam shielding means.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will be clear from the following description of
15 the preferred embodiments made with reference to the attached drawings, in which:

Fig. 1 is a perspective view of the external appearance for explaining a conventional IMS (not having the function of an IBS) of the integral drawn shape type;

20 Fig. 2 is a perspective view of the external appearance for explaining a conventional IMS (not having the function of an IBS) comprising two pieces;

Fig. 3A is a perspective view of the external appearance for explaining a conventional IMS (not having
25 the function of an IBS) comprising four pieces;

Fig. 3B is a perspective view of the external appearance for explaining a conventional IMS (not having the function of an IBS) comprising four pieces;

Fig. 4 is a perspective view of the external appearance for explaining a conventional IMS (having the function of an IBS) comprising two pieces;

Fig. 5 is a development for explaining the method of manufacturing an IMS shown in Fig. 4;

Fig. 6 is a perspective view of the external appearance for explaining a conventional IMS (having the function of an IBS) comprising six pieces;

Fig. 7 is a perspective view showing the external appearance of an IMS according to a first embodiment of the present invention;

Fig. 8 is a perspective view showing a disassembled CRT in which an IMS shown in Fig. 7 is used;

Fig. 9 is a development for explaining a method of manufacturing the IMS shown in Fig. 7;

Fig. 10A is a cross-sectional views of the IMS along line X-X in Fig. 7;

Fig. 10B is a cross-sectional views of the IMS along line X-X in Fig. 7;

Fig. 10C is a cross-sectional views of the IMS along line X-X in Fig. 7;

Fig. 11 is a cross-sectional views for explaining the

state when stacking a plurality of the IMS's shown in Fig. 7;

Fig. 12 is a perspective view showing the external appearance of an IMS according to a second embodiment of the present invention; and

Fig. 13 is a view showing the characteristic of mislanding due to terrestrial magnetism in an IMS according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Before explaining the preferred embodiments, the related art will be described in further detail with reference to the drawings for reference purposes.

Figure 1, Fig. 2, Fig. 3A and Fig. 3B are perspective views showing the external appearances of IMS's being used in conventional CRT's and not themselves functioning as IBS's.

The IMS 1 shown in Fig. 1 has an integral drawn shape. The IMS 2 shown in Fig. 2 is fabricated by joining the pieces 2a and 2b, which are formed by cutting and bending single thin sheets, at the joining portions 15 by welding, calking, etc. The IMS 3 shown in Fig. 3A and 3B is fabricated by joining the A-parts 4a and 4b with the B-parts 5a and 5b, which are formed by cutting thin sheets as shown Fig. 3A, at the joining portions 6 as shown Fig.

3B by welding, calking, etc.

Figure 4 and Fig. 6 are perspective views showing the external appearances of IMS's functioning also as IBS's and used in conventional CRT's.

5 The IMS 7 shown in Fig. 4 is fabricated by joining the parts 7a and 7b, which are formed by cutting and bending a thin sheet as shown in Fig. 5, at the joining portions 9 by welding, calking, etc.

The IMS 7 has the IBS 8 formed integrally with it.

10 The IMS 11 shown in Fig. 6 is fabricated by joining the A-parts 12a and 12b, the B-parts 13a and 13b, and the IBS portions 14a and 14b by welding, calking, etc.

However, the above-mentioned CRT's using the IMS's 1, 2, and 3 shown in Fig. 1, Fig. 2, Fig. 3A and Fig. 3B
15 require the separate provision of an IBS, so suffer from the disadvantage of high cost.

Further, while the IMS 7 shown in Fig. 4 enables lower costs because of having the IBS portion 8, it is necessary to join the parts 7a and 7b during the
20 manufacturing process and the work efficiency is poor.

Further, the IMS 11 shown in Fig. 6 or the IMS shown in Japanese Unexamined Patent Publication (Kokai) No. 6-124661 suffers from the complexity in the manufacturing process and high costs since the A-parts 12a and 12b,
25 B-parts 13a and 13b, and IBS portions 14a and 14b are

joined by welding. Further, the IMS 11 suffers from the disadvantage that when stacking a plurality of IMS's for transport etc., the IBS portions 14a and 14b and B-parts 13a and 13b will engage and therefore it is not possible
5 to stack the adjoining IMS's close to each other and the stacking efficiency is poor.

Preferred embodiments of the present invention will now be explained in detail next with reference to the drawings.

10 First Embodiment

Figure 7 is a perspective view showing the external appearance of an IMS 20 according to the present embodiment.

As shown in Fig. 7, the IMS 20 has internal magnetic
15 shield portions 21a and 21b corresponding to the first piece and the second piece, internal beam shield portions 22a and 22b, mounting portions 23, a body portion 25, and lengthwise side tongues 26. Depressions 24 are formed in the body portion 25, and projections 27 are formed on the
20 lengthwise side tongues 26.

As shown in Fig. 8, the IMS 20 is provided in a CRT between a funnel 20 and an aperture grille 10 affixed to the aperture grille 10. The aperture grille 10 is affixed to a panel 31.

25 As shown in Fig. 9, the IMS 20 is formed as a single

piece by punching out from a single sheet by pressing etc.
to form a punched-away portion 40 and cutting and bending
the remainder etc. There is no need for welding, calking,
etc. in the manufacturing process. At this time, the IMS
5 20 may be manufactured by working a single thin sheet by a
plurality of presses by an assembly line or by working it
by a single press which can perform a plurality of
pressing operations. The pressing is performed for example
about five times to produce the IMS 20 from the thin
10 sheet.

The internal magnetic shield portions 21a and 21b are
formed by cutting and bending the thin sheet shown in Fig.
9 by pressing etc., are positioned symmetric about a
center line along the lengthwise direction, and have the
15 bent portions 21a1 at the two ends of one side. The
internal magnetic shield portions 21a and 21b function to
shield from terrestrial magnetism.

The internal beam shield portions a and 22b are
formed by cutting and bending the thin sheet shown in Fig.
20 9, are positioned symmetric about a center line along a
widthwise direction, and function to shield from
unnecessary electron beams outside of the effective screen
of the CRT or prevent unnecessary electron beams from
striking the frame of a shadow mask and reflecting to the
25 effective screen.

The internal beam shield portions a and 22b are formed positioned so as not to overlap with the internal magnetic shield portions 21a and 21b, including the bent portions 21a, in the front direction.

5 By making the positional relationship between the internal magnetic shield portions 21a and 21b and the internal beam shield portions a and 22b in this way, when stacking a plurality of the IMS's 20, it is possible to have the internal magnetic shield portions 21a and 21b and
10 the internal beam shield portions 22a and 22b of adjacent internal magnetic shields be positioned close to each other.

Accordingly, with this IMS 20, it is possible to avoid having the IMS portions 14a and 14b and the B-parts
15 13a and 13b engage as in the IMS 11 shown in Fig. 6 and the stacking efficiency falling.

Figure 10A, 10B, and 10C give partial cross-sectional views of an IMS 20 along the line X-X in Fig. 7.

As shown in Fig. 10A, the beam shield portion 22a is
20 formed so as to be positioned bent with respect to the body portion 25 toward a direction (direction of arrow A) opposite to the direction of the internal magnetic shield portions 21a and 21b shown in Fig. 7. The beam shield portion 22b is similar to the beam shield portion 22a. The
25 beam shield portion 22a, for example, as shown in Fig.

10B, may also be formed to be positioned bent with respect to the body portion 25 toward the direction of the internal magnetic shield portions 21a and 21b (direction of arrow B) or, as shown in Fig. 10C, may also be formed by two bends formed by bending in the direction of the arrow A at the body portion 25 side and bending in the direction of the arrow B at the front end side. By bending the front end twice in this way, it is possible to effectively avoid the electron beams in the cathode ray tube striking the internal beam shield and being output toward the aperture grille.

The mounting portion 23 is formed by cutting and bending the thin sheet shown in Fig. 9 and is formed so as to be positioned bent as shown in Fig. 10A. It is affixed to the mounting portion 126 of the aperture grille.

The lengthwise side tongues 26 are formed by cutting and bending the thin sheet shown in Fig. 9, are positioned symmetric about a center line of the length-wise direction, and have projections 27 at predetermined locations.

The projections 27 are formed by pressing and function to prevent the entire surface of the IMS 20 from coming in close contact with another IMS 20 when stacking a plurality of IMS's 20 and to facilitate the removal of an IMS 20.

The depressions 24 are formed by pressing the four corners of the body portion 25 and function to increase the strength. It is also possible to provide projections instead of the depressions 24.

5 As described above, the IMS 20 is fabricated by cutting and bending a single thin sheet using pressing etc. Accordingly, the manufacturing process is simple, and it is possible to reduce the manufacturing costs.

10 Further, since the IMS 20 has the internal beam shield portions 22a and 22b, it is able to integrally function as both an IBS and IMS. Therefore, by using the IMS 20 for a CRT, there is no need to separately attach an IBS. Since there is no longer a need for an apparatus for fabricating the IBS etc., it is possible to reduce the
15 manufacturing costs of the CRT.

Further, from prototypes etc., the IMS 20 has better characteristics than conventional IMS's.

Figure 13 is a view showing the positions for comparing the characteristics on the effective screen of a
20 CRT used when comparing a CRT using the IMS 20 according to the present embodiment and a CRT using a conventional IMS.

That is, the amounts of mislanding caused by terrestrial magnetism are approximately the same at the
25 point A (Y end) shown in Fig. 13, with the pp value (m) of

the aberration being "48" in the IMS 20 and "47" in the conventional IMS.

On the other hand, the amount of mislanding caused by the terrestrial magnetism is much more improved with the
5 IMS 20 at the point B (corner) shown in Fig. 13, with the pp-value (m) of the aberration being "39" in the IMS 20 and "67" in the conventional IMS.

Further, with the IMS 20, it is possible to obtain a high stacking efficiency and further removal is easy after
10 stacking.

Second Embodiment

Figure 12 is perspective view showing the external appearance of an IMS 30 according to the present embodiment.

15 As shown in Fig. 12, the IMS 30 is comprised by affixing the B parts 31a and 31b to the bent portions 21a1 of the internal magnetic shield portions 21a and 21b in the IMS 20 shown in Fig. 12 using welding, calking, etc. The B parts 31a and 31b are shaped not to overlap with the
20 internal beam shield portions 22a and 22b in the front direction of the IMS 30.

For example, if the IMS 30 is used in a large size CRT in which the effect of the unnecessary electron beams outside of the effective screen is great, it can suppress
25 that effect effectively.



What is claimed is:

1. A cathode ray tube comprising:
 - a faceplate panel;
 - a funnel joined along a sidewall of said panel;
 - 5 and
 - an internal magnetic shield, positioned in said funnel, and having a pair of long pieces positioned symmetrically about a horizontal axis of an effective screen on said panel and a pair of short pieces positioned
 - 10 parallel with a vertical axis of an effective screen on said panel,
 - said pair of long pieces and said pair of short pieces being formed in one piece by folding a sheet of metal.
- 15 2. A cathode ray tube comprising:
 - a faceplate panel;
 - a funnel joined along a sidewall of said panel;
 - and
 - an internal magnetic shield comprising an
 - 20 internal magnetic shielding means, having a first piece and a second piece located approximately symmetric about a center line parallel to a lengthwise direction, for shielding from the effects of a magnetic field in the cathode-ray tube, and an internal beam shielding means,
 - 25 positioned perpendicular with said first piece and said



second piece and approximately symmetric about a center line parallel to a widthwise direction, for shielding from unnecessary beams outside of an effective screen,

wherein said internal magnetic shielding means
5 and said internal beam shielding means are formed by partially cutting and bending a single sheet.

3. An internal magnetic shield as set forth in claim 2, wherein said internal magnetic shielding means further has a third piece and a fourth piece for engaging
10 with said first piece and said second piece and positioned approximately symmetric about a center line parallel to a widthwise direction.

4. An internal magnetic shield as set forth in claim 2, further comprising engaging portions for
15 providing a gap between adjacent internal magnetic shields when stacking a plurality of the internal magnetic shields and wherein said internal beam shielding means are positioned so as not to overlap with said internal magnetic shielding means in the front direction.

20 5. An internal magnetic shield as set forth in claims 2, wherein said first piece and said second piece of said internal beam shielding means are formed with their front ends bent toward the electron gun side.

6. An internal magnetic shield as set forth in
25 claims 2, wherein said internal beam shielding means is



formed with their front ends bent twice.

7. A method of manufacturing an internal magnetic shield comprising an internal magnetic shielding means, having a first piece and a second piece located

5 approximately symmetric about a center line parallel to a lengthwise direction, for shielding from the effects of a magnetic field in a cathode-ray tube, and an internal beam shielding means, positioned perpendicular with said first piece and said second piece and approximately symmetric

10 about a center line parallel to a widthwise direction, for shielding from unnecessary beams outside of an effective screen, said method

preparing a single sheet;

first partially cutting said sheet to form said

15 internal magnetic shielding means;

second partially cutting said sheet to form said internal beam shielding means;

first partially bending said sheet to form said internal magnetic shielding means; and

20 second partially bending said sheet to form said internal beam shielding means,

to thereby form said internal magnetic shield having said formed internal magnetic shielding means and said formed internal beam shielding means.