

The invention relates to a shadow mask support frame for a cathode-ray colour display tube, which is both lightweight and rigid and easy to manufacture.

5 Cathode-ray colour display tubes include a metal sheet pierced with a multitude of holes or slits, called a "shadow mask", placed between the electron gun and the display screen. This shadow mask is intended to obtain a very sharp image by ensuring that the impacts of the electron beams on the display screen are located
10 precisely on the phosphors placed on the display screen.

The shadow masks are supported by frames of generally rectangular shape which hold them in position near the display screen and, optionally, ensure that they are tensioned so as to limit any deformation resulting
15 from local heating generated by the electron beams.

According to a known technique, a shadow mask support frame has two lateral upstands, consisting of metal tubes or of angle sections, and two end upstands, consisting of angle sections or of tubes placed on the
20 lateral upstands and joined together by welding at the points of contact. Given the method of construction, the tubes or angle sections must be relatively thick in order to obtain sufficient stiffness. The frames thus formed are suitable for tensioned shadow masks, but have the
25 drawback of being heavy and difficult to manufacture with good geometrical precision.

According to another known technique, a shadow mask frame consists of angle sections produced from thin strips shaped so as to form angle sections which are
30 joined together by welding. In a variant, the frame is produced by drawing a generally rectangular metal sheet having a central cut-out, which is also rectangular. The frames thus produced have the advantage of being lightweight but have the disadvantage of not being very
35 rigid and, consequently, poorly suited to supporting

tensioned shadow masks.

In order to improve the stiffness of lightweight frames, it has been proposed, especially in Patent Application FR 2,749,104, to manufacture such frames from
5 two thin metal strips placed against each other and having vertical and horizontal stiffening ribs. These frames are both lightweight and rigid, allowing them to be used for tensioned shadow masks, but they have the drawback of sometimes being difficult to manufacture.

10 The object of the present invention is to remedy these drawbacks by providing a shadow mask support frame which is both lightweight and rigid and easy to manufacture.

For this purpose, the subject of the invention is a
15 shadow mask support frame for a cathode-ray colour display tube, of generally rectangular shape, comprising two end upstands, lying opposite each other and intended to house a shadow mask, and two lateral upstands, intended to keep the end upstands apart. The said end
20 upstands and the said lateral upstands are of generally tubular shape and constitute an almost continuous closed hollow body containing at least one plane closed line located entirely inside the hollow body and passing inside each of the said end and lateral upstands. This
25 frame consists of at least one thin metal membrane.

The frame may, for example, consist of two thin metal membranes drawn so as to form an external shell and an internal shell, the two shells being fitted, one in the other, so as to form a hollow body.

30 The two shells may be made either of the same material or of two different materials.

The frame may also consist either of a single metal membrane folded so as to form a hollow body, or of several metal membranes folded so that each forms a
35 hollow body constituting a frame portion, the frame

portions then being joined together.

5 The end upstands, intended to house a shadow mask, may have a generally triangular cross section and include a flap along the upper arris, to which flap the edge of a shadow mask may be welded. They may also have a generally trapezoidal cross section so as to have an upper arris wide enough to allow welding of an edge of a shadow mask. The upper arris may be rectilinear or curvilinear.

10 The lateral upstands may have a cross section of any shape, and in particular a rectangular shape, or preferably a trapezoidal shape.

 The frame may more particularly be intended to house a tensioned shadow mask.

15 The metal membrane or membranes of which the frame is composed are made of a metallic material taken, preferably, from the following materials: low-carbon steels, iron-based alloys, iron-nickel alloys, iron-chromium alloys, nickel-based alloys, structural-hardening alloys, martensitic-type hardening alloys, magnetic alloys, non-magnetic alloys and vibration-damping alloys. When the frame is made of several materials, these may be chosen, for example, so that the thermal expansion coefficient of the lateral upstands is different from the thermal expansion coefficient of the end upstands.

25 The invention also relates to a process for manufacturing a frame, in which a strip having the developed shape of the frame or of the frame portion or a plurality of strips having the developed shape of a plurality of complementary frame portions is cut from a sheet of metallic material, the strip or strips are folded along a plurality of lines so as to form the frame or the frame portions and, when the frame is made from a single piece, the edges of the strip which are

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superimposed one with respect to the other are fastened together by welding, brazing or clinching. When the frame is made from several pieces, for each of the frame portions, the edges of the strip which are superimposed one with respect to the other are fastened together by welding, brazing or clinching, and the frame portions are joined together by fastening them together by welding, brazing or clinching.

Preferably, the welding is laser welding or electron-beam welding. The shadow mask support frames thus obtained are both very rigid and very lightweight. Furthermore, they are easy to manufacture with a very high geometrical precision. In addition, they exhibit very good vibration behaviour and, in particular, significant damping.

The invention will now be described in greater detail, but in a non-limiting manner, with regard to the appended figures in which:

- Figure 1 shows schematically a shadow mask frame on which a shadow mask, shown partially, is placed;
- Figure 2 shows two shells intended to be fitted together in order to form a shadow mask support frame;
- Figure 3 shows a shadow mask support frame consisting of a single folded metal strip;
- Figure 4 shows a quarter of a shadow mask support frame consisting of a single folded metal strip;
- Figure 5 shows a metal strip which comprises four panels separated by cut-outs and is intended for the manufacture of a shadow mask support frame consisting of a single folded metal strip;
- Figure 6 is an enlarged view of the cut-out separating two panels of a strip intended to manufacture a shadow mask support frame consisting of a single folded metal strip;
- Figure 7 shows a quarter of a shadow mask support

frame consisting of a single folded strip having indentures along the upper arris of an end upstand;

5 - Figure 8 shows the same quarter of a shadow mask support frame as in Figure 7, but with a partial cut-away of the wall;

 - Figures 9a and 9b represent, in perspective, from the front and the back respectively, an end upstand whose upper arris is curvilinear;

10 - Figure 10 shows schematically, in perspective, a quarter of the field scanned by an electron beam emitted by an electron gun and passing through a shadow mask support frame;

15 - Figure 11 shows a quarter of a shadow mask support frame, an end upstand of which has a trapezoidal cross section;

 - Figures 12a, 12b and 12c show schematically, in perspective, shadow mask support frames made from one piece, two pieces and four pieces, respectively;

20 - Figures 13a, 13b and 13c show schematically three ways of connecting a lateral upstand to an end upstand;

 - Figure 14 shows, in exploded perspective, one corner of a shadow mask support frame and a fastener for fixing the frame in a cathode-ray tube;

25 - Figure 15 shows, in perspective, a quarter of a four-piece frame.

 Figure 1 shows schematically a shadow mask 1 mounted on a shadow mask support frame 2. The frame 2 has a generally rectangular shape and comprises two lateral upstands 3, 3' and two end upstands 4, 4'. The shadow mask 1 consists of a thin metal sheet, for example 30 made of an iron-nickel alloy having a low expansion coefficient, pierced by a plurality of holes 5 and fixed by welding to the rims 6, 6' of the end upstands 4, 4'. Various shapes of shadow mask are possible, and these 35 shapes are well known to those skilled in the art. In

the particular case in Figure 1, the mask has a shape in the form of a portion of a cylinder, but the shadow mask may also be plane. The shadow mask 1 may be tensioned, that is to say subjected to tension parallel to the lateral upstands 3 of the frame 2 (only one lateral upstand being visible in the figure). In order to tension the shadow mask, two opposed forces are applied to the end upstands 4, 4' so as to move these upstands slightly closer together, by elastic deformation, the shadow mask is welded to the rims 6, 6' and the forces exerted on the upstands is released.

The frame which has just been described in a general way may be placed on a horizontal plane surface, or reference plane, the shadow mask then being above the horizontal plane surface. This makes it possible to define, for each component of the frame, an upper arris or face located nearest the reference plane and an upper arris or face located further from the reference plane. When a shadow mask support frame is mounted in a cathode-ray tube, the upper arrises or faces defined above are located on the same side as the screen and the lower arrises or faces are located on the opposite side (on the same side as the electron gun). In order to make the description easier to understand, it will be assumed below that the shadow mask support frame is placed on a horizontal reference plane.

The tensioned shadow mask support frame according to the invention comprises lateral and longitudinal upstands which have a generally tubular shape and form an almost continuous hollow body; the expression "almost continuous hollow body" should be understood to mean a hollow body whose internal part may be locally obstructed. The lateral and end upstands are placed in such a way that it is possible to trace a closed plane line entirely contained in the hollow body and passing

inside each of the upstands. It is this structure which gives the frame according to the invention its rigidity, especially because the forces are transmitted from an end upstand to a lateral upstand along a line located inside the lateral upstand. Several embodiments are possible. A few of these will be described by way of example.

In a first embodiment (Fig. 2), the frame 8 consists of an external shell 10 and of an internal shell 30 fitted together one in the other so as to form a continuous hollow body. The two shells are obtained by drawing metal blanks of generally rectangular shape, having a central rectangular cut-out. Each of the shells forms a metal membrane.

The external shell 10 has the shape of a rectangular box, comprising end walls 14, 14', side walls 16, 16' and a bottom open by a wide rectangular cut-out 11 leaving only a strip 12 extending all around the inner periphery of the external shell. The edge of the strip 12 defining the rectangular cut-out 11 is bent back upwards so as to form a border. Each end wall 14, 14' has a circularly arcuate upper end 15, 15'. Each side wall 16, 16' includes an indent 19 so that the height of its central part 17 is less than the height of its ends 18a, 18b. The upper edges of the end walls 14, 14' and side walls 16, 16' form a continuous arris 20 having a flap 21 oriented towards the outside of the external shell (in a variant, these flaps may be oriented towards the inside of the shell). The corners 22 are cut so as to have a triangular inclined surface which can be used for fixing means for suspending the frame inside a cathode-ray tube.

The internal shell 30, having a shape complementary to that of the external shell 10, is a complex surface comprising two end faces 31, 31' roughly plane and inclined towards each other, and two cylindrical lateral

faces 32, 32'. This surface is bounded, on the one hand, by an outer arris 33, having a rim 34 oriented towards the outside, the shape and dimensions of which are identical to those of the upper arris 20 of the external shell 10, and, on the other hand, by an inner arris 35, having a rim 36 oriented towards the inside and being of identical shape and size to those of the rectangular cut-out 11 in the bottom of the external shell 10.

The shadow mask support frame is obtained by fitting the internal shell 30 into the external shell 10 in such a way that:

- the outer border 33 of the internal shell 30 engages with the upper border 20 of the external shell 10;
- the inner border 36 of the internal shell 30 engages with the strip 12 of the external shell 10, the border 13 of the strip 15 being fitted into the opening defined by the inner border 36 of the internal shell 30.

The two shells are fastened together along their rims by welding, by brazing or by clinching.

The two shells thus fitted together form a continuous hollow body having a generally rectangular shape and a flat bottom, so that the lateral and end upstands lie in the same plane. This structure has the advantage of being both very rigid and very lightweight and of having a very good geometrical precision. The rigidity is high enough for the shadow mask support frame to be able to be made of two shells whose thickness may vary, depending on the size of the cathode-ray tube and the type of alloy used, between 200 μm and 1500 μm and for it to be able to be used as a support frame for a tensioned shadow mask.

Other shapes may be produced, in particular the edges may all be rectilinear, the side walls of the lower shell may include stiffening ribs and the surfaces of the

upper shell may be more or less plane or somewhat domed.

The two shells are made of a metallic material such as a low-carbon steel, an iron-based alloy, an iron-nickel alloy, an iron-chromium alloy, a nickel-based alloy, a structural-hardening alloy, a martensitic-type hardening alloy, a magnetic alloy, a non-magnetic alloy or a vibration-damping alloy.

The two shells may be made of the same material or of two different materials having, for example, different expansion coefficients.

Each shell may be made of two different materials, one forming the lateral upstands and the other the end upstands of the shadow mask support frame. To do this, each shell is produced from a composite blank obtained by butt-welding strips made of alloys of different nature. When the frame is intended to support a tensioned shadow mask, the materials may be chosen so that the thermal expansion coefficient of the lateral upstands is different from the thermal expansion coefficient of the end upstands, thereby making it possible to ensure that, in the end, the tension in the shadow mask is hardly affected by the temperature variations during manufacture of the cathode-ray tube.

In a second embodiment, the shadow mask support frame consists of a continuous, or almost continuous, rectangular hollow body obtained by folding a suitably cut metal strip. The metal strip, cut beforehand as will be described in greater detail below, is folded so as to form upstands of generally tubular shape, being connected in such a way that it is possible to trace inside the hollow body a closed plane line passing inside each upstand. The shadow mask support frame then consists of a single metal membrane.

The shadow mask support frame 39 (Fig. 3) comprises two lateral upstands 40, 40' of rectangular cross section

and two end upstands 41, 41' of triangular cross section. The lateral upstands 40, 40' are shorter than the end upstands 41, 41' so that the arrises 43, 43', of the end upstands 41, 41', intended to house the shadow mask (not shown) project therefrom.

The lower corners 42, at the junction between a lateral upstand and an end upstand, are cut so as to have inclined plane surfaces able to house means for fixing the shadow mask support frame in the cathode-ray tube.

As may be seen in Figure 4, each lateral upstand 40 is obtained by folding a strip in such a way that two walls 44 and 45 are of single thickness and two walls 46 and 47 are of double thickness so as to increase the rigidity of the assembly. The single-thickness wall 44 may include openings 48 allowing the introduction of welding means for fastening together the two thicknesses of the wall 47 by welding.

It should be noted that the openings 48 are not essential and that it is possible to produce a weld along the arris 51, at the junction of the faces 45 and 47 of the lateral upstand 40, either by laser welding from the outside, for example by means of a laser weld along a continuous line, or by a plurality of laser spot welds distributed along the double-thickness wall 47.

As may also be seen in Figure 4, the end upstand 41 is obtained by folding a strip whose edges are bent back so as to form flaps 49 and 50 which fit together, one inside the other, so as to form the upper arris 43 intended to house the shadow mask. The assembly is fastened together by a weld along the flap 50.

The frame thus constructed forms an almost continuous hollow body comprising end and lateral upstands whose lower faces lie in the same plane.

The frame 39 that has just been described can be produced from a single strip having the developed shape

of the frame, shown in Figure 5. This shape is obtained by opening out the frame at one of its corners, then by unfolding it so as to align all its upstands and then by unfolding the walls of the upstands. The strip thus
 5 obtained allows the frame to be reconstructed by folding.

The strip 60 comprises two panels 61, 61' corresponding to the end upstands 41, 41' and two panels 62, 62' corresponding to the lateral upstands 40, 40', arranged alternately. Two successive panels 61 and 62
 10 are separated by a cut-out 63, the shape of which is such that, after folding, the ends of the lateral and end upstands fit together, one inside the other, and such that the corner is broken. The folds are formed along the dotted lines.

As may be seen in Figure 6, the panel 61 corresponding to the end upstand 41 is folded along two main lines aa and bb so as to form the faces 54, 55 and 56 of the end upstand of triangular cross section and along two complementary lines cc and dd in order to form
 15 the flaps 49 and 50.
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The panel 62 corresponding to the lateral upstand 40 is folded along five lines ee, ff, gg, hh and ii so as to form an upstand of rectangular cross section. The cut-out 63 leaves a small rhombus-shaped strip 64
 25 carrying, on one of its sides, a triangle 65 corresponding to the cut corner 42 of the frame and, on the other side, a flap 66. The triangle 65 also has two flaps 67.

On the side of the panel 61, the cut-out has a
 30 straight edge 68 and a triangular indent 69 allowing the cut corner 42 to be formed.

On the side of the panel 62, the cut-out forms a broken line 70 defining projecting and reentrant parts which, after folding, will ensure good connection between
 35 the lateral and end upstands.

After folding, the various parts which interact are fastened together by welding, especially along all the arrises, visible from the outside, which do not correspond to folds. This is particularly the case with
5 the arrises 52 and 53, corresponding to the junction between a lateral upstand 40 and an end upstand 41, and with the flap 50.

The shadow mask support frame thus produced forms a continuous hollow body which is very rigid, lightweight
10 and has very good geometrical precision while being easy to manufacture. It also has the advantage of exhibiting very favourable vibration behaviour, particularly because it has excellent damping properties. This frame is particularly suitable for the support of a tensioned
15 shadow mask.

As in the previous embodiment, the shadow mask support frame may be made of a metallic material such as a low-carbon steel, an iron-based alloy, an iron-nickel alloy, an iron-chromium alloy, a nickel-based alloy, a
20 structural-hardening alloy, a martensitic-type-hardening alloy, a magnetic alloy, a non-magnetic alloy or a vibration-damping alloy.

The strip may also be a composite strip, the panels 61 and 61' being made of a first alloy and the panels 62
25 and 62' being made of a second alloy.

In a preferred variant of the above embodiment, shown especially in Figures 7 and 8, the end upstand 80 is of triangular cross section, as in the previous case, and includes, along its upper arris 83, a flap 84
30 intended to house a shadow mask. However, the inclined wall 81 is joined to the vertical wall 82 precisely along the arris 83, just beneath the flap 84, the assembly being achieved by a plurality of spot welds placed at the bottom of indentures 85 arranged along the edge of the
35 inclined wall 81. These indentures are produced, for

example, by drawing before the membrane is folded. This arrangement has the advantage of improving the mechanical strength of the upper arris 83.

5 The lateral upstand 86 is of square cross section, a single wall 87 of which is of double thickness. The two thicknesses of the wall 87 are fastened together by a plurality of spot welds (not visible in the figure) distributed over the entire length of the lateral upstand. These spot welds are produced, for example, by
10 laser welding from the outside. The welding may also be in the form of a weld seam or a plurality of weld seams.

 As may be seen in Figure 8, the lateral upstand 86 fits into the end upstand 80 and penetrates the inside so that its inner face 93 rests on the lower face 88 of the
15 end upstand, thereby allowing them to be fastened together by laser welding from the outside. The lateral upstand 86 may extend as far as the vertical wall 82 of the end upstand - in this case the hollow body is "almost continuous" - or on the contrary it may stop before
20 touching this wall 82 - in this case the hollow body is continuous since no wall prevents a continuous passage from the inside of the lateral upstand to the inside of the end upstand being formed. It may be noted that the length of that part 92 of the lateral upstand which lies
25 inside the end upstand has a strong influence on the rigidity of the assembly and that this rigidity may be adjusted by choosing this length as required.

 The end upstand 80 is joined to the lateral upstand 86 by means of flaps 89, 90 and 91 fastened by welding to
30 the walls of the upstand with which they interact. It should be noted that the flap 89 allows the end of the wall 87 of the lateral upstand 86 to be fastened to the inclined wall 81 of the end upstand 80. This is because the wall 87 is extended by a trapezoidal part 87'
35 (partially visible in Figure 8) which obstructs the end

of the end upstand 80. This arrangement has the advantage of improving the rigidity of the end upstand.

It should be noted, as shown in Figures 9a and 9b, that the upper arris 95 of the end upstand 96, intended to house a shadow mask, may be curvilinear, the curve formed by the upper arris 95 lying neither in a vertical plane nor in a horizontal plane. In this case, to allow good connection between the vertical face 97 and the inclined face 98, these two faces include dished regions 99 and 100, forming surfaces which can be joined along the arris 95. These dished regions have a generally domed shape, the concavity of which is preferably oriented towards the inside of the upstand, thereby improving the mechanical behaviour of the latter. The longitudinal upstands 101 and 102 are not modified with respect to the previous embodiment.

In the embodiment that has just been described, the lateral upstands have a square cross section. However, and in order to reduce the shadow effects on the lateral edges of the shadow mask as far as possible, the lateral upstands may have a trapezoidal or triangular cross section. As shown in Figure 10, the electron gun 105 located beneath the shadow mask support frame 106 emits an electron beam which scans the pyramidal volume represented by the broken lines 107. The end upstand 108 of the shadow mask support frame 106 is of triangular cross section and has an inclined face 109 almost parallel to one face of the pyramidal volume defined by the broken lines 107. The lateral upstand 110 has a trapezoidal cross section, having an inclined face 111 approximately parallel to one face of the pyramidal volume defined by the broken lines 107.

It should also be noted, as shown in Figure 11, that the end upstand 112 may also have a trapezoidal cross section and have a narrow upper face 113 intended

to house the shadow mask.

In the embodiment that has just been described, with its variants, the frame is made from a metal strip suitably cut and then folded so as to form an almost
5 continuous hollow body, having touching parts fastened together by welding.

However, when the dimensions of the frame are not too great, it is possible to produce it from a single piece 115, as shown in Figure 12a; on the other hand,
10 when the frame is very large, the developed length is such that it becomes very difficult to handle a strip of this length. The frame may then be made from several pieces obtained by folding and are subsequently joined together. It is possible, for example, to produce the
15 frame from two pieces 116 and 116', each corresponding to a lateral upstand 117 or 117' and an end upstand 118 or 118'. It is also possible to produce the frame from four pieces corresponding, on the one hand, to the two end upstands 119 and 120 and, on the other hand, to the two
20 lateral upstands 121 and 122.

The embodiments described above are not limiting. Further equivalent forms are possible. In particular, it is possible for the lateral upstands not to comprise double-thickness walls but simply flaps from one wall
25 onto the other so as to make them easier to weld. It may even be possible for there not to be flaps, the welding then being edge to edge. Likewise, the double-thickness wall or walls are not necessarily the outer side walls or the inner walls as indicated in the figures, but any wall
30 that a person skilled in the art may choose, for example depending on the manufacturing conditions in order to make manufacture easier. Likewise, it is possible for the upper arris of an end upstand intended to house a shadow mask not to include a flap, it being possible for
35 the shadow mask to be welded in any suitable manner that

a person skilled in the art may choose, depending on the manufacturing means available (for example, seam welding along an arris).

Further alternative embodiments are possible, especially when the frame is manufactured from several parts. For example, as shown in Figure 15, the end upstands 160 may have lateral-upstand initiators 161, the lateral upstands 162 then being tubes which are fitted into the lateral-upstand initiators or into which the lateral-upstand initiators are fitted.

Likewise, the manufacture of a frame obtained by folding may be achieved by other methods of folding. In particular, it is possible to carry out the folding using a cut blank corresponding to a development of the frame carried out in a different way from that described.

In all the embodiments that have just been described, the lower faces of the lateral upstands and of the end upstands lie approximately in the same plane. With this arrangement, from a structure's mechanical standpoint, the end upstands bear on the ends of the lateral upstands. This characteristic may be obtained in various configurations as shown in Figures 13a, 13b, 13c. In the three cases, the upper face 132 of the lateral upstand lies below the upper arris 133 of the end upstand but either the lower face 130 of the end upstand is in the same plane as the lower face 131 of the lateral upstand, or it is below it, or it is above it but below the upper face 132 of the lateral upstand. In all cases, it is possible to define at least one plane P on which it is possible to trace at least one closed curve entirely located inside the hollow body that the frame forms and passing inside each of the upstands. An example of a continuous line is also shown in Figure 8 in which may be seen the plane P and the line AA' in broken lines. Admittedly, this figure only shows a quarter of the

frame, but the reader will understand that by joining the four quarters of the frame together the line AA' is extended in order to form a closed continuous line lying within the plane P and lying inside the four upstands of the frame. In this figure, the lateral upstand 93 is not extended as far as the external wall 82 of the end upstand 80, so that the hollow body is continuous. In an alternative embodiment, the lateral upstand 93 could extend as far as the external wall 82 of the end upstand. In this case, the line AA' would necessarily pass through that part 92 of the lateral upstand 93 which lies inside the end upstand so that the hollow body would not be absolutely continuous but almost continuous since it is locally obstructed by the internal walls. This alternative embodiment illustrates what is meant by an "almost continuous" hollow body.

When it is mounted in a cathode-ray tube, the shadow mask support frame is held in position by fasteners which may be of various shapes, fixed to the frame by welding, clip-fastening or screw-fastening.

The fastener 140 shown in Figure 14 is fixed to the frame in a corner 141 both by clip-fastening and by screw-fastening. To do this, firstly the fastener 140 has two tabs 144 and 145 and two holes 148 and 149 and secondly the frame has (in each corner intended to house a fastener) two slots 142 and 143 and two holes 150 and 151. The clip-fastening is achieved by inserting the tabs 144 and 145 of the fastener 140 into the slots 142 and 143 and the screw-fastening is achieved by screwing two screws 146 and 147 through the holes 148 and 149 into the holes 150 and 151. In this example, the lower corner 152 of the frame is cut, thereby creating a hole in the wall of the frame. This hole may be used for removing the cleaning liquids used throughout the process of manufacturing the frame. It may also be used for

adjusting the deformation of the frame when forces are applied to the two end upstands before the shadow mask is welded. This adjustment may be done by choosing the size of the hole suitably.



CLAIMS

1. Shadow mask support frame for a cathode-ray colour display tube, of generally rectangular shape, comprising two end upstands (4, 4', 41, 41', 80, 96, 108, 112, 117, 117', 119, 120, 160) lying opposite each other and intended to house a shadow mask, and two lateral upstands (3, 40, 40', 86, 101, 102, 110, 118, 118', 121, 122, 162) intended to keep the end upstands apart, characterized in that the said end upstands and the said lateral upstands are of generally tubular shape and constitute an almost continuous closed hollow body containing at least one plane closed line located entirely inside the hollow body and passing inside each of the said end and lateral upstands.

2. Frame according to claim 1, characterized in that it consists of at least one thin metal membrane.

3. Frame according to claim 1 or claim 2, characterized in that it consists of a single metal membrane folded so as to form a hollow body (115).

4. Frame according to claim 1 or claim 2, characterized in that it consists of two half-frames joined together, each half-frame (116, 116') comprising a lateral upstand (118, 118') and an end upstand (117, 117') and each half-frame consisting of a single folded metal membrane.

5. Frame according to claim 1 or claim 2, characterized in that it consists of two end upstands (119, 120, 160) and two lateral upstands (121, 122, 162) joined together, each end upstand and each lateral upstand consisting of a folded metal membrane.

6. Frame according to any one of claims 3 to 5, characterized in that at least one end upstand (41, 41', 80, 96) has a generally triangular cross section.

7. Frame according to claim 6, characterized in



that at least one end upstand (41, 41', 80, 96) includes, along its upper arris (43, 83), a flap (49, 84) forming a thin strip intended to house a shadow mask.

5 8. Frame according to claim 6 or claim 7, characterized in that at least one end upstand (80, 96) comprises, on one of the two faces (81, 98) adjacent to the upper arris (83, 95), a plurality of indentures (85) arranged along the said upper arris and intended for joining the two adjacent faces together by welding.

10 9. Frame according to any one of claims 6 to 8, characterized in that the upper arris (95) of the end upstand (96), intended to house a shadow mask, is curvilinear.

15 10. Frame according to claim 9, characterized in that at least one face (97, 98) of the end upstand (96), adjacent to the upper arris (95) intended to house a shadow mask, includes a dished region (99, 100) so as to allow the edges of the two adjacent faces to interact continuously along the upper arris.

20 11. Frame according to any one of claims 6 to 10, characterized in that the said end upstand (41, 41', 80, 96, 108, 117, 117', 119, 120) having a triangular cross section comprises a face (56, 81, 98, 109) lying opposite the inside of the frame and inclined with respect to the plane of the frame.

25 12. Frame according to any one of claims 3 to 5, characterized in that at least one end upstand (112) has a generally trapezoidal cross section and includes an upper face (113) in the form of a narrow strip and
30 intended to house a shadow mask.

13. Frame according to any one of claims 3 to 12, characterized in that at least one lateral upstand (40, 40', 86, 101, 102, 118, 118', 121, 122) has a generally rectangular cross section.

35 14. Frame according to any one of claims 3 to 12,



characterized in that at least one lateral upstand (110) has a generally trapezoidal cross section and includes a face (111) lying opposite the inside of the frame and inclined with respect to the plane of the frame.

5 15. Frame according to claim 13 or claim 14, characterized in that at least one face (46, 47, 87) of the said lateral upstand (40, 40', 86, 101, 102, 110, 118, 118', 121, 122) includes at least two thicknesses of metal membrane.

10 16. Frame according to claim 15, characterized in that the said at least two thicknesses of metal membrane are fastened together by a plurality of spot welds extending along the said lateral upstand or by a weld seam.

15 17. Frame according to any one of claims 3 to 16, characterized in that the lateral upstands (40, 40', 86, 101, 102, 110, 118, 118', 121, 122) are fitted into the end upstands (41, 41', 80, 96, 108, 117, 117', 119, 120).

20 18. Frame according to any one of claims 3 to 17, characterized in that the edges of the metal membrane or membranes interacting with each other are fastened together by welding, for example by laser welding.

25 19. Frame according to any one of claims 3 to 18, characterized in that the metal membrane is made of a metallic material taken from the following materials: low-carbon steels, iron-based alloys, iron-nickel alloys, iron-chromium alloys, nickel-based alloys, structural-hardening alloys, martensitic-type hardening alloys, magnetic alloys, non-magnetic alloys and vibration-damping alloys.

30 20. Frame according to any one of claims 3 to 18, characterized in that the metal membrane is made of two metallic materials taken from the following materials: low-carbon steels, iron-based alloys, iron-nickel alloys,
35 iron-chromium alloys, nickel-based alloys, structural-



hardening alloys, martensitic-type hardening alloys, magnetic alloys, non-magnetic alloys and vibration-damping alloys.

21. Frame according to claim 20, characterized in
5 that the two materials are chosen and arranged in such a way that the thermal expansion coefficient of the lateral upstands (40, 40', 86, 101, 102, 110, 118, 118', 121, 122, 162) is different from the thermal expansion coefficient of the end upstands (41, 41', 80, 96, 108,
10 117, 117', 119, 120, 160).

22. Frame according to claim 1 or claim 2, characterized in that it consists of two thin metal membranes, the first thin metal membrane forming an external shell (10) and the second thin metal membrane
15 forming an internal shell (30), the two shells being fitted together one inside the other so as to form a hollow body.

23. Frame according to claim 22, characterized in that at least one shell (10, 30) is formed by drawing a thin metal blank of generally rectangular shape, having a
20 rectangular cut-out at its centre.

24. Frame according to claim 22 or claim 23, characterized in that each shell (10, 30) is made of at least one metallic material taking from the following
25 materials: low-carbon steels, iron-based alloys, iron-nickel alloys, iron-chromium alloys, nickel-based alloys, structural-hardening alloys, martensitic-type hardening alloys, magnetic alloys, non-magnetic alloys and vibration-damping alloys; the two shells may be made
30 either of the same material or of two different materials.

25. Frame according to claim 24, characterized in that at least one shell is made of two different materials.

35 26. Frame according to any one of claims 1 to 25,



characterized in that it is intended to house a tensioned shadow mask.

5 27. Process for manufacturing a frame according to
any one of claims 3 to 22, characterized in that a strip
(60) having the developed shape of the frame or a
plurality of strips having the developed shape of a
plurality of complementary frame portions is cut from a
sheet of metallic material, the strip or strips are
folded along a plurality of lines so as to form the frame
10 or the frame portions and, when the frame is made from a
single piece, the edges of the strip which are
superimposed one with respect to the other are fastened
together by welding, brazing or clinching and, when the
frame is made from several pieces, for each of the frame
15 portions, the edges of the strip which are superimposed
one with respect to the other are fastened together by
welding, brazing or clinching, and the frame portions are
joined together by fastening them together by welding,
brazing or clinching.

20 28. Process according to claim 27, characterized
in that the welding is laser welding or electron-beam
welding carried out from outside the frame.