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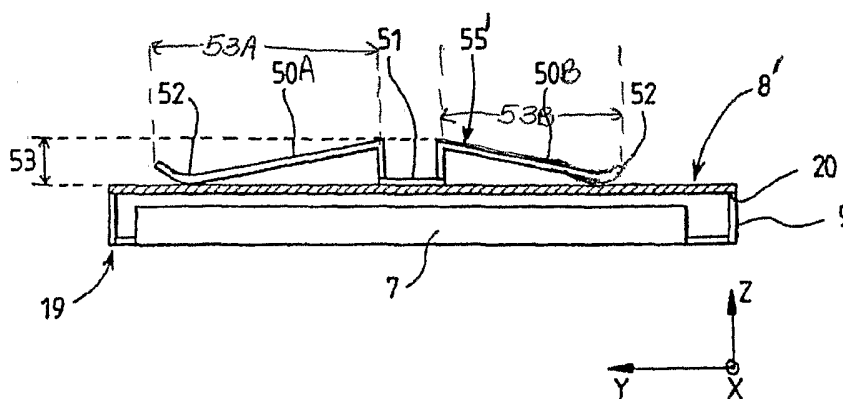
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(54) Title: DAMPER FOR A CATHODE-RAY TUBE (CRT) TENSION MASK



(57) Abstract: A tension mask for a cathode-ray tube (CRT) is described. The tension mask includes a damper (551). The damper has at least a first portion (50A) and at least a second portion (50B). The first portion and the second portion each have different resonant frequencies. Having two (or more) portions of the damper with different resonant frequencies provides a broader range of frequencies for which the damper has a forced-vibration response.

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DAMPER FOR A CATHODE-RAY TUBE (CRT) TENSION MASK

CROSS-REFERENCE TO RELATED APPLICATIONS

5 This application claims the benefit of U. S. Provisional Patent Application Serial No. 60/618,724 (Atty Docket PU040281), entitled "ASYMMETRIC DAMPER FOR A CATHODE RAY TUBE (CRT) TENSION MASK" and filed October 14, 2004, which is incorporated by reference herein in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

15 The present invention relates to a color selection mask structure for color cathode-ray tubes (CRTs). The invention finds its application in any type of tube comprising a color selection mask and is more particularly adapted to a tube having a mask therein held under tension by a frame to which it is secured.

2. Description of the Background Art

20 Conventional cathode-ray tubes include a color selection mask situated a precise distance from the inside of the glass front face of the tube, on which front face are deposited grids of red, green and blue luminophores so as to form a screen. An electron gun disposed inside the tube, in its rear part, generates three electron
25 beams directed toward the front face. An electromagnetic deflection device, generally disposed outside the tube and close to the electron gun, has the function of deviating the electron beams so as to make them scan the surface of the panel on which the grids of luminophores are disposed. Under the influence of three electron beams each corresponding to a specified primary color, the grids of luminophores allow the
30 reproduction of images on the screen, the mask enabling each specified beam to illuminate only the luminophore of the corresponding color.

The color selection mask must be disposed and held during the operation of the tube in a precise position inside the tube. The mask holding functions are carried out by virtue of a generally rectangular metal frame to which the mask is

conventionally welded. The frame/mask assembly is mounted in the front face of the tube by virtue of suspension means which are typically welded to the frame and cooperate with pegs inserted into the glass constituting the front face of the tube.

Recently, the trend is to produce tubes having flatter front faces, with a
5 tendency towards totally flat front faces. To make tubes including a flat front face, requires the use of a flat mask held under tension in at least one direction.

Since the color selection mask consists of a metal foil of very small thickness, its tensioning can give rise to unwanted phenomenon of setting the mask into vibration while the tube is operating. Under the influence of shock or outside
10 mechanical vibrations, for example acoustic vibrations due to the loudspeakers of the television set into which the tube is inserted, the mask can start to vibrate at its natural resonant frequency. The vibrations of the mask consequently modify the zone of landing of the electron beams on the screen of the tube. The points of impact of each beam are then shifted with respect to the associated luminophore grid, thus
15 creating a decoloration of the image reproduced on the screen.

U. S. Patent No. 6,614,152 B1 proposes a damper that is attached to the face of the mask for damping the vibration of the mask at a single resonant frequency. This provides a narrow window for high forced-vibration response.

Thus, a need exists for a damper that dampens the vibration of the mask at
20 more than one frequency to provide a broad window for forced-vibration response.

25 **SUMMARY OF THE INVENTION**

The present invention relates to a tension mask for a cathode-ray tube (CRT). The tension mask includes a damper. The damper has at least a first portion and at least a second portion. The first portion and the second portion each have different
30 resonant frequencies. Having two (or more) portions of the damper tuned differently provides a broader range of frequencies for which the damper has a forced-vibration response. This allows the damper to accommodate variations in mask edge frequency from mask/frame assembly to mask/frame assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in greater detail, with relation to the accompanying drawings, in which

5 FIG. 1 represents a cathode ray tube according to the invention, seen partially cut away;

FIG. 2 shows a prior art frame/mask assembly without a vibration damper;

FIG. 3 shows a frame/mask assembly with a prior art vibration damper;

FIG. 4 illustrates one embodiment of the vibration damper of the present

10 invention;

FIG. 5 illustrates another embodiment of the vibration damper of the present invention;

Fig. 6 illustrates yet another embodiment of the vibration damper of the present invention;

15 FIG. 7 depicts a perspective view of the vibration damper of the present invention;

FIG. 8 shows, in perspective view, the detail of an end portion of the vibration damper of the present invention; and

20 FIG. 9 illustrates a positioning means for positioning the vibration damper on the mask.

DETAILED DESCRIPTION

As illustrated by FIG. 1, a cathode-ray tube 1 according to the invention

25 comprises a substantially flat faceplate 2 and a peripheral skirt 3. The faceplate 2 is connected to the rear part of the tube 1, having a shape of a funnel 4, by virtue of a sintered glass seal (not shown). The end part 5 of the tube 1 surrounds an electron gun 6 which emits electron beams that illuminate a luminescent screen 13 through a color selection mask 8. The color selection mask 8 is flat, for example, stretched

30 between long sides 9 of a frame 19. Metal supports of the mask/frame assembly hold this assembly inside the tube 1. The supports include a part 10 attached to the frame 19 and a part forming a spring 11, having an aperture for cooperating with a connector 12 incorporated within the glass skirt 3.

In the prior art example illustrated by FIG. 2, the frame 19' includes a pair of long sides 9' and a pair of short sides 7'. The long sides 9' and the short sides 7' have an L cross-section. The mask 8', having a substantially rectangular shape, is tensioned, and is held under tension, for example, by being welded to the ends 20' of the long sides 9' of the frame 19'.

The mask 8' comprises a metal foil, made for example of steel or Invar, that has a small thickness, of the order of about 100 μm . The mask 8' has a central zone 30' with apertures therethrough, generally disposed in columns and a peripheral zone 28' surrounding the central zone 30', with horizontal edges 31' and vertical edges 32'.

Cathode-ray tubes using tensioned color selection masks have to cope with the problem of the vibration of such mask, in modes which are natural thereto, when the mask is excited by outside vibrations, such as, for example, mechanical shocks on the tube or sound vibrations originating from loudspeakers disposed in proximity to the tube. Since these vibrations are manifested by movements of the mask in a direction perpendicular to its surface, the distance between the apertures of the mask and the screen varies locally as a function of the amplitude of the vibration of the mask. The purity of the colors reproduced on the screen is then no longer guaranteed, the points of touchdown of the beams on the screen being shifted as a function of the amplitude of the vibration.

Moreover, since the mask is disposed inside the tube within which a high vacuum prevails, the vibrations of the mask are very slowly damped, the energy communicated to the mask having few means of dissipation, thus increasing the visibility of the color purity degradation on the screen when the tube is operating.

FIG. 3 illustrates one prior art solution for damping the vibrations of a tensioned mask 8, as described in U. S. Patent No. 6,614,152 B1. On a peripheral part 28 of the mask 8, for example, along the vertical short sides 32, is disposed a damping device 55 in the form of a strip having a central part 51, that is secured to the surface of the edge 28 of the mask 8 with two identical wings 50 extending on either side of the central part 51. The damping device 55 is comprised, for example of a metal strip that is stamped to form the two identical wings 50. The damping device 55 damps the vibrations of the mask at a single resonant frequency.

Fig. 4 illustrates one embodiment of the present invention for damping the vibrations of a tensioned mask 8'. On a peripheral part of the tensioned mask 8', for

example, along the vertical short sides, is disposed a damping device 55' of the present invention. The damping device 55' has at least a first portion 50A and at least a second portion 50B. The first portion and the second portion each have different resonant frequencies.

5 Referring to FIG. 4, in one embodiment, the damping device 55' may be formed of a single material, such as, for example a metal strip. For such an embodiment, first portion 50A and the second portion 50B may be tuned to have different resonant frequencies by varying the lengths thereof. For example, the first portion 50A has a first length 53A, while the second portion 50B has a second length
10 53B that is different from the first length 53A.

Mathematical modeling was performing using ANSYS™ software for the embodiment in which the first portion 50A and the second portion 50B have different lengths. For such example, when the first length 53A and the second length 53B of the first portion 50A and the second portion 50B, respectively were selected to be
15 about 8.5 % different, the resonant frequencies for the first portion 50A and the second portion 50B were about 9.4 % different.

Referring to FIG. 5, in another embodiment, the damping device 55' may be formed of two different materials. For such an embodiment, first portion 50A and the second portion 50B may be tuned to have different resonant frequencies by varying
20 the materials from which it is formed. For example, the first portion 50A is formed of a first material 54A, while the second portion 50B is formed of a second material 54B that is different from the first material 54A.

Mathematical modeling was performing using ANSYS™ software for the embodiment in which the first portion 50A and the second portion 50B are formed of
25 different materials. For such example, the lengths of the first portion 50A and the second portion 50B were kept the same, then when the first material 54A and the second material 54B of the first portion 50A and the second portion 50B, respectively were selected to have moduli that are about 40 % different, the resonant frequencies for the first portion 50A and the second portion 50B were about 18 % different.

30 Referring to FIG. 6, in yet another embodiment, the damping device 55' may be formed of a single material but with different thicknesses. For such an embodiment, first portion 50A and the second portion 50B may be tuned to have different resonant frequencies by varying the thicknesses of the material of which it is formed. For example, the first portion 50A is formed of a material having a first

thickness 55A, while the second portion 50B is formed of the same material having a second thickness 55B that is different from the first thickness 55A.

Mathematical modeling was performing using ANSYSTM software for the embodiment in which the first portion 50A and the second portion 50B are formed of a material with different thicknesses. For such example, the lengths of the first portion 50A and the second portion 50B were kept the same, then when the first thickness 55A and the second thickness 55B of the first portion 50A and the second portion 50B, respectively were selected to be about 10 % different, the resonant frequencies for the first portion 50A and the second portion 50B were about 12 % different.

The damping device 55' will form together with the mask 8' a system of coupled oscillators, the different resonant frequencies for each of the first portion 50A and the second portion 50B being chosen to be close to the natural frequency of the mask 8' in such a way that the vibrations of the damping device 55' will be subtracted from the vibrations of the mask 8'. Having two (or more) portions of the damping device 55' tuned differently provides a broader range of frequencies for which the damping device 55' has a forced-vibration response. This allows the damping device 55' to accommodate variations in mask edge frequency from mask/frame assembly to mask/frame assembly.

The invention offers a structure for damping the energy communicated to the mask during a shock to the tube or by way of sound waves. Specifically, it is necessary that the vibrations communicated to the mask, even if they are of low amplitude, should not be allowed to last for a long time, since they then become visible during the operation of the tube. Because the mask is located inside the tube in a vacuum, it may be necessary to add energy dissipation means so that the mask is rapidly damped. Referring to FIG. 7, it is advantageous for a part 52 of the first portion 50A and the second portion 50B to come in contact with the mask 8' when the latter vibrates. The vibration energy is then dissipated by friction between the parts 52 of the first and second portions 50A, 50B of the damper and the mask 8'.

The winged shape of the first and second portions 50A, 50B of the vibration damper of the present invention makes it possible to obtain maximum energy dissipation by friction because the parts 52 come in contact with the mask 8' near zones of low vibration amplitude, for example in the vicinity of the ends of the wings; the central part of the damper 51' being disposed in the zone of maximum amplitude of vibration of the mask. The parts 52 of the vibration damper will then rub on the

mask over a zone of sizable length proportional to the height 53 (shown in FIG. 4) of the wing measured with respect to the plane of the mask.

FIG. 8 shows, in a perspective view, the detail of an end 52' of a wing 50A' according to another embodiment. The end 52' sandwiches the edge 32 of the mask in such a way as to increase the surface of rubbing between the end 52' and the surface of the mask so as to dissipate the vibration energy of the mask more rapidly.

In addition, to reduce the time of oscillation of the mask 8', it is possible to append the wing of the damper 55' to have at least one annulus 60 passing through an orifice 61 in the wing, as illustrated in the embodiment shown in FIG. 7. The annulus may be opened or closed, its cross-section being slightly smaller than the diameter of the orifice 61 so as to be able to move in the orifice and dissipate the energy by friction on the edge of the orifice. Alternatively, rivets may be disposed in such a way as to pass through the orifices in the wings, the heads of the rivets having a greater dimension than that of the orifices whilst the body of the rivet has a smaller cross-section than the diameter of the orifice.

The layout of the coupled oscillators along the short sides 32' of the mask 8' is not limiting. For example, for the case where the mask is stretched in two directions parallel to its length and its width, it is advantageous to dispose the dampers on both faces of the mask so as to obtain the desired damping effect.

Means for positioning the coupled oscillator on the surface of the mask may be added without any complex modification of the structure the oscillator or the mask. These means have the objective of facilitating the positioning of the coupled oscillator on the edge of the mask during the tube manufacturing process. As illustrated in FIG. 7, these positioning means can consist of a tab 65 integral with the vibration damper 55' cooperating with a notch 66' situated on the edge of the mask 8'. Alternatively, the tab 65 can be integral with the mask 8' and the notch situated on the central part 51' of the vibration damper 55'. Further as illustrated in FIG. 9, the positioning means can consist of a boss 67' integral with the vibration damper 55' cooperating with an aperture 68' situated on the mask 8'.

Alternatively, the positioning means may consist of a boss intended to be inserted into a suitable aperture. The boss may be disposed either on the mask, and it then cooperates with an aperture disposed on a central part 51' of the vibration damper 55', or on the surface of the vibration damper 55', for example on its central part 51', and it then cooperates with an aperture disposed on the edge of the mask 8'.

Although an exemplary mask/frame assembly for a color cathode-ray tube (CRT) which incorporates the teachings of the present invention has been shown and described in detail herein, those skilled in the art can readily devise many other varied embodiments that still incorporate these teachings.

CLAIMS:

1. A cathode-ray tube, comprising:

5 a mask fixed under tension to a support frame and mounted inside the front face of the cathode-ray tube, the mask having a central region with orifices therethrough and a peripheral region disposed between the central region and edges of the mask, the mask being able to vibrate independently of the support frame; and
at least one damper disposed along the peripheral region of the mask, the damper comprising a first portion and a second portion extending from a center
10 portion, wherein each of the first portion and the second portion have different resonant frequencies.

2. The cathode-ray tube of claim 1 wherein the first portion has a first length and the second portion has a second length that is different from the first length.

15 3. The cathode-ray tube of claim 1 wherein the first portion is formed from a first material and the second portion is formed of a second material different from the first material.

20 4. The cathode-ray tube of claim 1 wherein the first portion has a first thickness and the second portion has a second thickness different from the first thickness.

25 5. The cathode-ray tube of claim 1 wherein the mask is under tension in a first direction and the first and second portions of the at least one damper extend in a direction that is parallel to the direction of tension of the mask.

6. The cathode-ray tube of claim 1 wherein the first portion contacts the peripheral region of the mask when the mask vibrates.

30 7. The cathode-ray tube of claim 1 wherein the second portion contacts the peripheral region of the mask when the mask vibrates.

8. A mask-frame assembly for a cathode-ray tube, comprising:

a mask fixed under tension to a support frame and mounted inside the front face of the cathode-ray tube, the mask having a central region with orifices therethrough and a peripheral region disposed between the central region and edges of the mask, the mask being able to vibrate independently of the support frame; and

5 at least one damper disposed along the peripheral region of the mask, the damper comprising a first portion and a second portion extending from a center portion, wherein each of the first portion and the second portion have different resonant frequencies.

10 9. The mask-frame assembly of claim 8 wherein the first portion has a first length and the second portion has a second length that is different from the first length.

10. The mask-frame assembly of claim 8 wherein the first portion is formed from a first material and the second portion is formed of a second material different from the
15 first material.

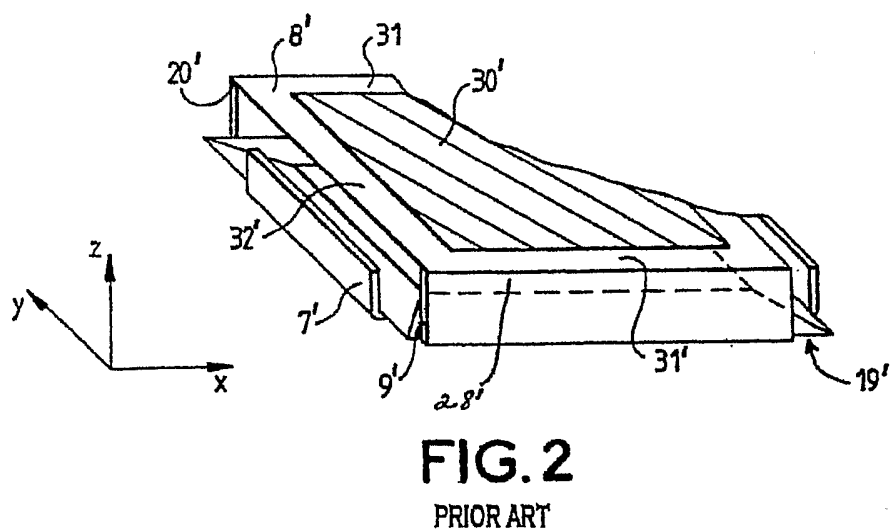
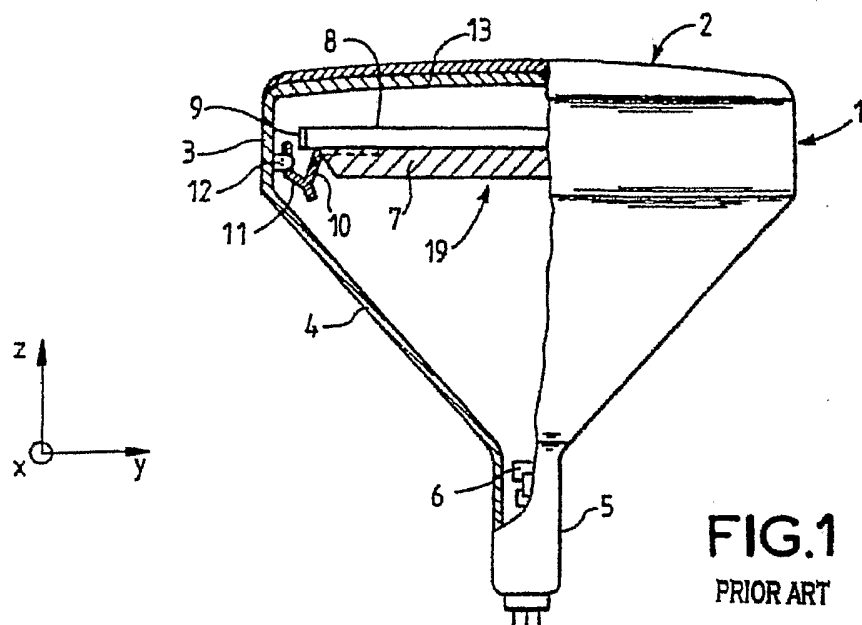
11. The mask-frame assembly of claim 8 wherein the first portion has a first thickness and the second portion has a second thickness different from the first thickness.

20 12. The mask-frame assembly of claim 8 wherein the mask is under tension in a first direction and the first and second portions of the at least one damper extend in a direction that is parallel to the direction of tension of the mask.

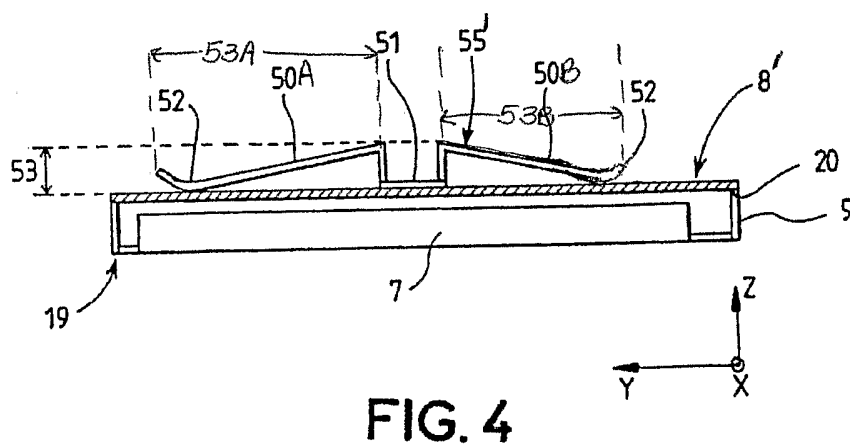
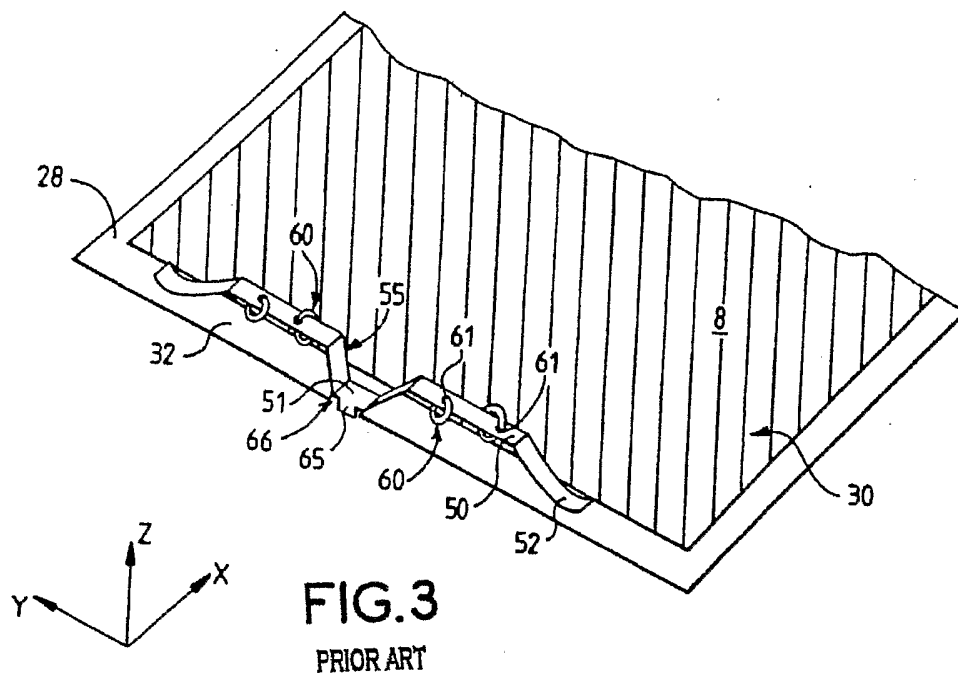
25 13. The mask-frame assembly of claim 8 wherein the first portion contacts the peripheral region of the mask when the mask vibrates.

14. The mask-frame assembly of claim 8 wherein the second portion contacts the peripheral region of the mask when the mask vibrates.

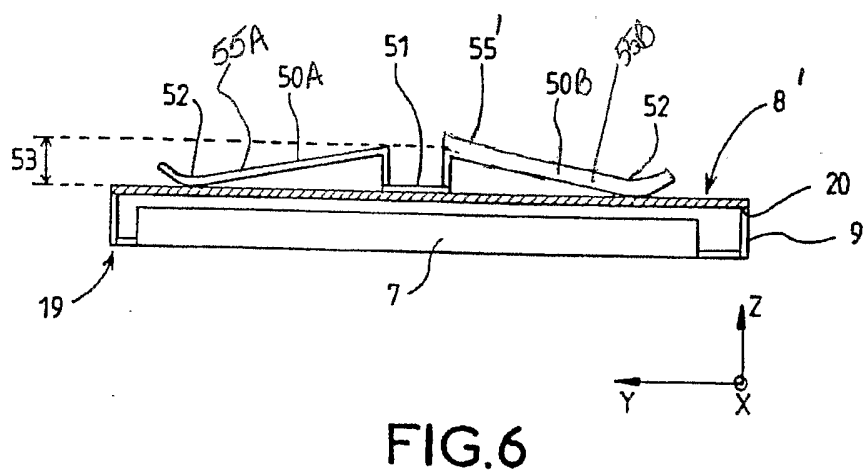
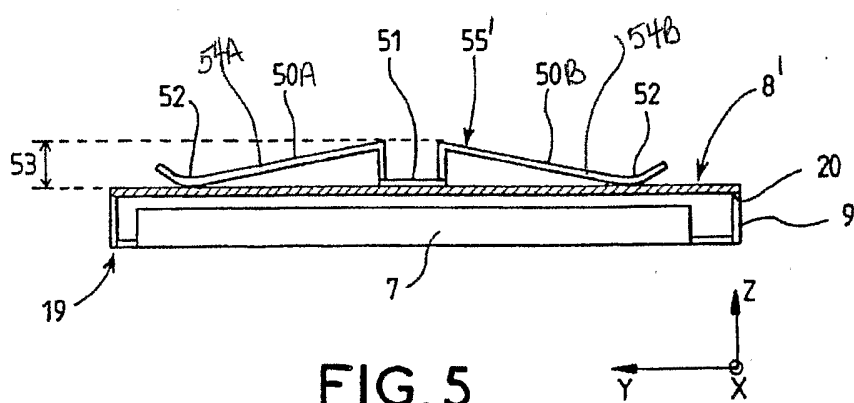
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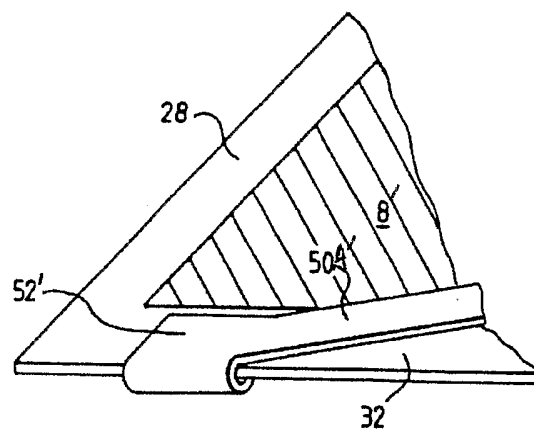
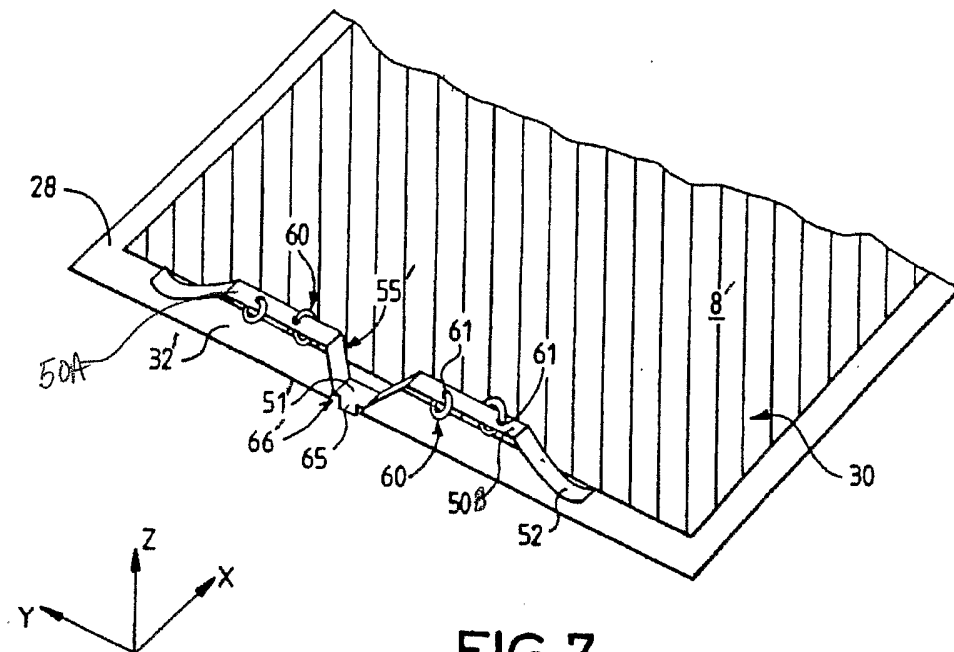
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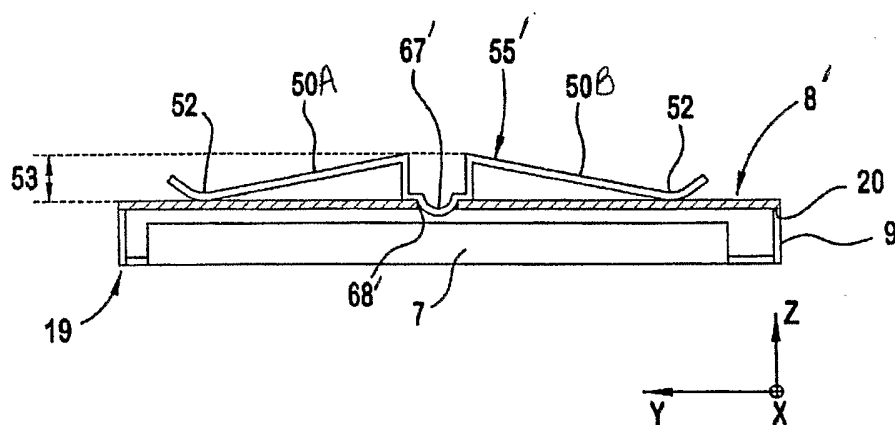


FIG. 9

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US2005/036402

A. CLASSIFICATION OF SUBJECT MATTER

H01J29/07

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 614 152 B1 (BERTON FABRIZIO ET AL) 2 September 2003 (2003-09-02) cited in the application column 3, lines 13-22; figure 3	1-5,8-12
A	columns 3-5; figures 5-9	6,7,13, 14
X	US 4 827 179 A (ADLER ET AL) 2 May 1989 (1989-05-02) column 8, lines 9-49; figures 11,2,9	1-5,8-12



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

16 January 2006

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2005/036402

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 6614152	B1	02-09-2003	CN	1302077 A	04-07-2001
			IT	MI992324 A1	07-05-2001
			JP	2001143633 A	25-05-2001
			MX	PA00010842 A	06-06-2003
			TW	495789 B	21-07-2002
US 4827179	A	02-05-1989	BR	8807560 A	10-04-1990
			CA	1279362 C	22-01-1991
			DE	3888196 D1	07-04-1994
			EP	0383766 A1	29-08-1990
			JP	3500591 T	07-02-1991
			KR	9614800 B1	19-10-1996
			WO	8810006 A1	15-12-1988