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(54) **FLAME SIMULATING ASSEMBLY WITH FLICKER ELEMENT INCLUDING PADDLE ELEMENTS**

FLAMMENSIMULATIONSANORDNUNG MIT FLACKERELEMENT EINSCHLIESSLICH
PADDELELEMENTE UND VERFAHREN ZUR BEREITSTELLUNG VON FLAMMENBILDERN

ENSEMBLE SIMULATEUR DE FLAMME AVEC ÉLÉMENT DE PAPILLOTEMENT COMPRENANT
DES PALETTES ET METHODE POUR PRODUIRE DES IMAGES DE FLAMMES

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Description**FIELD OF THE INVENTION**

[0001] The present invention is a flame simulating assembly with a flicker element including a rod and a number of paddle elements located on the rod in predetermined locations.

BACKGROUND OF THE INVENTION

[0002] In the typical electric fireplace, images of flames are created by projecting light onto a screen, and the flame images are moved generally upwardly on the screen. In the prior art electric fireplace, however, the light intensity across each of the flame images tends to be substantially uniform. This is thought to be undesirable because it is unrealistic, as real flames tend to have variations in intensity across their respective breadths.

[0003] In addition, the typical electric fireplaces tend to provide intermittent flashes of light on the screen thereof that travel in a partially transverse direction, rather than generally upwardly. These transversely travelling flashes are unlike flames in a real wood or coal fire. The transversely travelling light flashes therefore tend to undermine the realistic effect that is sought to be achieved.

[0004] US2016/0258585 describes an arrangement per the preamble of claim 1.

SUMMARY OF THE INVENTION

[0005] There is a need for a flame simulating assembly that overcomes or mitigates one or more of the disadvantages or defects of the prior art. Such disadvantages or defects are not necessarily included in those described above.

[0006] In its broad aspect, the invention provides a flame simulating assembly according to claim 1. Advantageous features are provided in the dependent claims

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The invention will be better understood with reference to the attached drawings, in which:

Fig. 1A is an isometric view of an alternative embodiment of the flame simulating assembly of the invention, drawn at a smaller scale;

Fig. 1B is a side view, partially cut away, of the flame simulating assembly of Fig. 1A;

Fig. 1C is an isometric view of a portion of an alternative embodiment of the flicker element of the invention, drawn at a larger scale;

Fig. 2A is a top view of an alternative embodiment of a paddle element of the invention, drawn at a larger

scale;

Fig. 2B is a top view of the paddle element of Fig. 2A when the paddle element is mounted on a rod in the flicker element of Fig. 1C;

Fig. 2C is a side view of the paddle element and the rod of Fig. 2B, before the paddle element is mounted on the rod;

Fig. 2D is another side view of the paddle element and the rod of Figs. 2B and 2C in which the paddle element is mounted on the rod;

Fig. 2E is a back view of the paddle element and the rod of Figs. 2B and 2D in which the paddle element is mounted on the rod;

Fig. 3A is a cross-section of a single paddle element of Fig. 2B mounted on the rod and located in a first position, drawn at a smaller scale;

Fig. 3B is a cross-section of the paddle element and the rod of Fig. 3A, rotated to a second position;

Fig. 3C is a cross-section of the paddle element and the rod of Fig. 3B, rotated to a third position;

Fig. 3D is a cross-section of the paddle element and the rod of Fig. 3C, rotated to a fourth position;

Fig. 3E is a cross-section of an embodiment of the paddle element of the invention in which one of the middle parts and the side parts adjacent thereto are all non-coplanar relative to each other;

Fig. 3F is a cross-section of an embodiment of the paddle element of the invention in which one of the middle parts and the side parts adjacent thereto are coplanar relative to each other;

Fig. 4A is a top view of a portion of the paddle element positioned as shown in Fig. 3A and certain other elements of the flame simulating assembly; and

Fig. 4B is a top view of the portion of the paddle element positioned as shown in Fig. 3B and certain other elements of the flame simulating assembly.

DETAILED DESCRIPTION

[0008] In the attached drawings, like reference numerals designate corresponding elements throughout.

[0009] Embodiments of the invention are illustrated in Figs. 1A-4B. In one embodiment, the flame simulating assembly 220 of the invention preferably includes one or more light sources 222 (Fig. 1B) for producing light, a screen 224 to which the light from the light source 222

is directed, to provide a plurality of images 226 of flickering flames thereon (Fig. 1A), and a rotatable flicker element 232 (Fig. 1C). It is preferred that the flicker element 232 includes an elongate rod 234 defined by an axis 236 thereof about which the rod 234 is rotatable, and a number of paddle elements 238 located in respective predetermined locations on the rod 234 (Fig. 1C). As will be described, each of the paddle elements 238 preferably includes one or more body portions 240 having one or more reflective surfaces 242 thereon. Preferably, and as shown in Fig. 1B, the reflective surface 242 includes a central region 244 and a perimeter region 246 at least partially located around the central region 244, the perimeter region 246 at least partially defining a perimeter plane "2PR". It is also preferred that the paddle elements 238 are located in the respective predetermined locations therefor to position the perimeter plane "2PR" substantially perpendicular to the axis 236, for intermittently reflecting the light from the light source 222 from the reflective surface 242 to predetermined regions 245 on the screen 224 respectively (Figs. 1A, 1B) as the flicker element 232 rotates about the axis 236, to provide the images of flickering flames on the screen 224. Preferably, because the central region 244 is substantially non-planar and the perimeter region is at least partially planar, the light reflected therefrom to the screen 224 as the flicker element 232 rotates has varying intensity at the respective predetermined regions on the screen 224. As will also be described, it is also preferred that the perimeter region 246 includes one or more middle parts 247 and one or more side parts 249 (Fig. 1C). As shown in Fig. 1, the middle part 247 preferably is at least partially defined by one or more channels 253 partially separating the middle part 247 and the side part(s) 249.

[0010] As will also be described, the middle part and the side part(s) preferably are formed to reflect the light from the light source so as to provide a realistic flame effect. It will be understood that the middle part and the side part(s) as illustrated are exemplary, and that they may have any suitable configuration.

[0011] In one embodiment, the side parts preferably include a first side part 249A and a second side part 249B (Fig. 2A). Also, the one or more channels preferably include first and second channels 253A, 253B (Fig. 2A). In the embodiment illustrated, e.g., in Fig. 2A, the middle part 247 is at least partially defined by the first and second channels 253A, 253B, the first channel 253A being located between the middle part 247 and the first side part 249A, and the second channel 253B being located between the middle part 247 and the second side part 249B.

[0012] Preferably, the perimeter region 246 includes base regions 257A, 257B that are adjacent to the side parts 249A, 249B respectively (Figs. 2A, 2B).

[0013] In the embodiments illustrated in Figs. 1A-4B, it is preferred that the paddle elements 238 are mounted on the rod 234 so as to be substantially equally spaced apart from each other, as will be described.

[0014] Preferably, when mounted on the rod, the re-

spective body portions 240 of the paddle elements 238 are positioned substantially at 45° radially relative to the respective body portions 240 of the paddle elements 238 that are positioned on the rod 234 adjacent thereto, for reflection of the light from the light source 222 toward the predetermined regions on the screen 224 when the rod 234 is rotated.

[0015] It will be understood that the body portions 240 of the paddle elements 238 may be positioned radially relative to each other in any desired relationship. As will be described, the rod 234 preferably includes a rod body 274 coaxial with the axis 236 and a number of mounting elements 276 located at predetermined positions along the rod body 274. Preferably, the mounting elements are located on the rod body for positioning the paddle elements in the respective predetermined locations therefor.

[0016] It is also preferred that the mounting elements are spaced substantially equidistant apart from each other along the rod body.

[0017] The rate of rotation of the flicker element 232 preferably is taken into account when determining the arrangement of the paddle elements relative to each other along the rod 234.

[0018] Preferably, and as can be seen in Figs. 2A-2E, the body portion 240 includes a first side 254 and an opposed second side 256 thereof, and at least a selected one of the first and second sides 254, 256 includes the reflective surface 242. It is preferred that each of the first and second sides 254, 256 includes reflective surfaces. For clarity of illustration, in Figs. 3A-3D, the central region and the perimeter region on the first side 254 are identified by reference numerals 244' and 246' respectively, and the central region and the perimeter region on the second side 256 are identified by reference numerals 244" and 246" respectively. In one embodiment, the central region 244' on the first side 254 preferably is at least partially convex relative to the perimeter region 246' on the first side 254, and the central region 244" on the second side 256 is at least partially concave relative to the perimeter region 246" on the second side 256. For clarity of illustration, the convex central region 244 is identified by the reference numeral "2J" in Fig. 2B, and the concave central region is identified by the reference numeral "2K" in Fig. 2E. It will be understood that the convex central region "2J" is convex relative to the perimeter plane "2PR". Similarly, it will be understood that the concave central region "2K" is concave relative to the perimeter plane "2PR".

[0019] As can also be seen in Figs. 2A-2E, in one embodiment, each of the paddle elements 238 preferably includes two body portions (identified by reference numerals 240A, 240B for convenience) connected by a bridge portion 258. Preferably, the bridge portion 258 includes an inner connector 260 and a pair of outer connectors 262, 264 generally located on opposite sides of the inner connector 260 (Fig. 2A). As can be seen in Fig. 2B, the body portions 240A, 240B preferably are at least partially defined by respective perimeters "2Pi", "2P₂". It

is preferred that the outlines of the body portions 240A, 240B (i.e., as defined by the perimeters "2Pi", "2P₂") are substantially the same, i.e., they are mirror images of each other.

[0020] The base regions 257A, 257B of the perimeter region 249 preferably extend to the bridge portion 258 (Figs. 2A, 2B). As will be described, when the paddle element 238 is mounted on the rod 234, the base regions 257A, 257B tend to define the perimeter plane "2PR". Other parts of the perimeter region 246 may be bent so that they are not in the perimeter plane "2PR".

[0021] When the paddle elements 238 are mounted on the rod 234, the paddle elements 238 preferably are subjected to tension as a result, and this causes the paddle elements 238 to be formed so that they have the central regions 244 that are bent or curved, to provide the non-planar regions. However, the base regions 257A, 257B, which are located adjacent to the bridge portion 258, preferably remain at least partially substantially planar after the paddle element 238 thereof is subjected to tension when mounted on the rod 234, as aforesaid.

[0022] As will be described, the differences between the central region 244 and the perimeter region 246 result in differences in the light from the light source that is reflected from these two different regions of the reflective surface 242 to the screen 224. Similarly, differences among the middle part 247, the side parts 249A, 249B, the central region 244, and the base regions 257A, 257B result in differences in the light from the light source that is reflected therefrom to the screen 224. These differences have been found to provide a realistic flame effect on the screen 224, which simulates the flames of a fire.

[0023] Those skilled in the art would appreciate that the paddle elements 238 may be formed of any suitable materials, and that the central region 244, and the perimeter region 246, may be formed in any suitable way. It is preferred that the paddle elements 238 include, or are made of, material that is highly reflective, i.e., adapted for specular reflection. As will also be described, it is also preferred that the paddle element 238 is made of material that is resilient and flexible. Those skilled in the art would be aware of suitable materials. For example, it has been found that the paddle elements 238 may be made of reflective Mylar®, preferably from sheets that are approximately 7 mil (0.007 inch, or approximately 0.1778 mm) thick.

[0024] In one embodiment, the paddle element 238 preferably is formed by cutting the paddle element 238 out of a sheet of suitably flexible material, e.g., reflective Mylar®. Also, it is preferred that the outer connectors 262, 264 and the inner connector 260 are at least partially defined by cuts 265, 266 that partially separate the outer connectors 262, 264 from the inner connector 260 respectively (Fig. 2A).

[0025] It is also preferred that the channels 253A, 253B are formed by cutting material out of the sheet of suitable material. Those skilled in the art would appreciate that the channels 253A, 253B may be cut after the basic out-

line of the body portions 240A, 240B has been formed.

[0026] Alternatively, the paddle elements 238 and/or the features thereof may be formed using any other suitable methods and materials, as would be appreciated by those skilled in the art. For example, the paddle elements and/or the body portions thereof may be formed using injection molding.

[0027] It will be understood that the body portions 240A, 240B and the bridge portion 258 may have any suitable size, shape or form. In one embodiment, and as can be seen in Fig. 8A, the body portions 240A, 240B preferably each have generally rounded sides and pointed or peaked tips or outer ends "2Q₁", "2Q₂", interrupted by the channels 253A, 253B. The paddle element 238 preferably narrows at the bridge portion 258. Those skilled in the art would appreciate that the paddle element preferably is relatively small. For example, the body portion's width "2W" from side to side may be a maximum of about 0.625 inch (approximately 1.59 cm), and the length "2L" from the central connector 256 to the outer end may be a maximum of about 0.75 inch (approximately 1.91 cm) (Fig. 2A). In one embodiment, each of the body portions 240A, 240B preferably are approximately the same size and shape.

[0028] It is also preferred that the inner connector 260 is integrally formed with the body portions 240A, 240B. The outer connectors 262, 264 preferably are also integrally formed with the body portions 240A, 240B. In each paddle element 238, the inner connector 260 and the outer connectors 262, 264 preferably are separated only by the respective cuts 265, 266 therebetween, in the bridge portion 258 (Fig. 2A).

[0029] As can be seen in Fig. 2A, the inner connector 260 preferably extends between its first and second ends 267, 268, where the inner connector 260 is integrally joined with the respective body portions 240A, 240B. Because of the cuts 265, 266, the inner connector's central portion 270 may be moved outwardly, i.e., away from the outer connectors 262, 264 (Fig. 2A). Such outward movement would be, for example, generally in the direction schematically indicated in Fig. 2C by arrow "2A". As can be seen in Fig. 2C, when the central portion 270 is moved outwardly from the outer connectors 262, 264, an opening or space 272 is defined between the central portion 270 and the inner connectors 262, 264.

[0030] Preferably, the paddle element is mounted on the rod as follows. When the paddle element 238 is to be mounted on the rod 234, the paddle element 238 is first compressed, or bent. The tips "2Q₁", "2Q₂" of the respective body portions 240A, 240B are moved toward each other. This causes the body portions 240A, 240B to pivot toward each other, as indicated by arrows "2T₁", "2T₂". As noted above, at the same time, the central portion 270 is moved or bent outwardly, to define the opening 272. The rod 234 is positioned in the opening 272, and while the paddle element 238 is compressed (so as to hold the opening 272 open), the paddle element 238 and/or the rod 234 is/are moved relative to each other

until the paddle element 238 is positioned at a selected one of the mounting elements 276, to locate the paddle element 238 in a preselected position therefor on the rod 234, relative to the other paddle elements.

[0031] When the paddle element 238 is located at its preselected position on the rod 234, the paddle element 238 preferably is released (i.e., the tips "2Q₁", "2Q₂" of the body portions 240A, 240B are allowed to move away from each other), and the central portion 270 is allowed to engage the mounting element 276. The inner connector 260 is allowed to move in the direction indicated by arrow "2B" in Fig. 2D. Also, and as can be seen in Figs. 2A, 2B, and 2E, the outer connectors 262, 264 engage adjacent parts of the rod body 274, and are urged in the direction indicated by arrow "2C" in Fig. 2D, to locate the paddle element 238 in its preselected position. From the foregoing, it can be seen that, once the paddle element 238 is mounted on the rod 234 in the predetermined location therefor, the inner connector 260 is urged against one side of the rod 234, and the outer connectors 262, 264 are urged against the opposite side of the rod 234. In this way, the paddle element 238 is relatively securely held in its predetermined location on the rod 234, i.e., spaced apart from the paddle elements mounted adjacent thereto.

[0032] When the paddle element 238 is located in its preselected position, it is subjected to tension, and consequently the central region 244 is puckered, or curved or bent, to form the central regions 244. In turn, because the middle part 247 and the central region 244 are joined at a connector part 255, the middle part 247 may at this point become bent or raised relative to the side parts, due to the curvature of the central region 244 (Fig. 2B). As a result, the middle part 247 may be non-coplanar with the perimeter plane "2PR". In the same way, when the central regions 244 are formed, the side parts 249A, 249B may also be bent due to the connection of the side parts 249A, 249B with the central regions 244 at the connectors 259A, 259B respectively (Fig. 2B).

[0033] As noted above, the paddle element 238 may be cut out of a relatively thin sheet of flexible plastic with a suitable (reflective) finish. It will be understood that a suitable material is a flexible, resilient material, i.e., preferably a material capable of substantially elastic deformation, and very little plastic deformation. Accordingly, when the tips "2Q₁", "2Q₂" of the body portions are moved toward each other, to form the opening 272, the deformation of the paddle element 238 is substantially an elastic deformation. That is, due to the flexibility of the material and because the extent of deformation is limited (i.e., the tips are only moved together to a limited extent), the material is not substantially elastically deformed. Because of this, when the pressure urging the tips "2Q₁", "2Q₂" of the body portions together is released, the tips of the body portions are urged apart from each other, because the paddle element 238 has a tendency to resiliently return to its generally planar, original, configuration.

[0034] It will be understood that the middle part 247

and the two side parts 249A, 249B may be positioned relative to each other in various ways. When the paddle element 238 is mounted on the rod 234, the paddle element 238 is subjected to tension, and the tension may cause one or more of the middle part 247 and the side parts 249A, 249B to bend relative to each other, and/or relative to the base regions 257A, 257B. It will be understood that, due to the connection of the base regions 257A, 257B to the bridge portion 258, the base regions 257A, 257B remain relatively planar after the paddle element 238 has been mounted on the rod 234.

[0035] Accordingly, in at least a selected one of the paddle elements 238, the first and second side parts 249A, 249B are substantially coplanar relative to each other. As will be described, this can be seen, e.g., in Figs. 3A-3D. Also, in at least a selected one of the paddle elements, the middle part 247 preferably is non-planar (Figs. 2B, 2E). As will be described, the effect resulting from mounting the paddle element 238 on the rod 234 may include bending one or more of the middle part and the side parts so that one or more of them may be bent somewhat, i.e., they may not be planar after mounting. Also, due to the tensions to which the paddle element 238 is subjected, even if the middle part and one or more of the side parts are substantially planar, the middle part and/or the side parts may be located in non-coplanar locations relative to each other after mounting.

[0036] Based on the foregoing, those skilled in the art would appreciate that, in at least a selected one of the paddle elements, the middle part 247 preferably is non-coplanar with the side parts 249A, 249B.

[0037] In another embodiment, in at least a selected one of the paddle elements 238, the side parts 249A, 249B and the middle part 247 preferably are non-coplanar (Fig. 3E).

[0038] In an alternative embodiment, in at least a selected one of the paddle elements 238, the middle part 247 and the side part(s) preferably are substantially coplanar (Fig. 3F).

[0039] Those skilled in the art would appreciate that the mounting elements 276 are formed in order to locate the respective paddle elements 238 relative to each other in their respective predetermined positions and retain the paddle elements therein. It would also be appreciated by those skilled in the art that the mounting elements may be formed in any suitable manner. In one embodiment, each mounting element 276 preferably includes one or more first region 282 formed for engagement with the inner connector 260, to position the paddle elements 238 in the respective predetermined locations therefor (Fig. 2D). It is preferred that the first region 282 is substantially planar (Fig. 2D).

[0040] Preferably, the first region 282 of each mounting element 276 is located at a predetermined position located radially relative to each other mounting element 276 adjacent thereto, for positioning the paddle elements 238 in the respective predetermined locations therefor (Fig. 1C). The mounting element 276 preferably also in-

cludes a second section 283 thereof that may be partially engaged by the side connectors 262, 264 when the paddle element 238 is mounted on the mounting element 276 (Figs. 2D, 2E).

[0041] In use, the light source is energized, and the flicker element is rotated about the rod's axis. When the flicker element is rotating, the light from the light source is directed to the reflective surface intermittently, to intermittently provide a first reflected light reflected from the middle part 247, a second reflected light reflected from the side part(s) 249A, 249B, and a third reflected light reflected from the non-planar region 244 to the screen to provide the images of flames on the screen. The images of flames 226 include respective portions thereof formed by the first reflected light and the second reflected light and the third reflected light, the first reflected light and the second reflected light having a different intensity on the screen relative to the third reflected light (Figs. 4A, 4B).

[0042] It will be understood that the light from the light source 222 is reflected from all parts of the reflective surface 242. For instance, the light is also reflected from the base regions 257A, 257B toward the screen 224 as the flicker element is rotated, when the base regions 257A, 257B are appropriately positioned.

[0043] As can be seen in Figs. 2B and 2E, it is preferred that the central region 244 of each of the body portions 240A, 240B of the paddle element 238 is generally convex on the first side 254 thereof (Fig. 2B) and generally concave on the second side 256 thereof (Fig. 2E). Due to the convex and concave regions, the body portions 240A, 240B are formed to have generally cupped shapes, i.e., they are non-planar, once the paddle element 238 is mounted on the rod 234.

[0044] It will be understood that the extent of the convexity and concavity of the central regions 244 is somewhat exaggerated as illustrated in Figs. 2B and 2E and 3A-3D. Also, the convexity and concavity of the central regions 244 is not shown in Figs. 1C, 2C, and 2D for clarity of illustration.

[0045] In use, as described below, the light forming the images 226 generally appears to vary in intensity within the images 226. This variation in intensity enhances the realistic effect provided by the assembly 220, as such variation is similar to variations in light intensity observable in flames in a real wood or coal fire, or a fire consuming other combustible materials. It is believed that the variation in light intensity within the image 226 is due, at least in part, to the cupped shapes of the body portions 240A, 240B. The intermittent nature of the reflection of the light from the flicker element 232 also contributes to the seemingly random fluctuations in the reflected light intensity. As will be described, it is also believed that the variation in light intensity within the images is also partly due to the forms of the middle part 247 and the side parts 249A, 249B. The different positioning of the middle part 247 and the side parts 249A, 249B relative to the perimeter plane "2PR" is also believed to cause variations in

light intensity within the images of flames 226.

[0046] As noted above, part of the light from the light source 222 reflected from a body portion 240 is reflected from the (substantially planar) base regions 257A, 257B, and another part of the light reflected from such body portion 240 is reflected from the convex or concave region "2J" or "2K", as the case may be. Additional light is reflected from the middle part 247 and the side parts 249A, 249B.

[0047] It will be understood that, as the flicker element 232 is rotated, the intensity of the light that is reflected by each body portion 240 and directed to the screen 224 to form the image of flames varies. This is thought to be because the light from the light source 222 is directed to the moving (i.e., rotating) body portion, causing the light to be reflected, at least in part, sequentially from the substantially planar base regions 257A, 257B, the non-planar central region 244, and the middle part 247 and the side parts 249A, 249B.

[0048] As can be seen in Fig. 1B, in one embodiment, the flame simulating assembly 220 preferably includes a flame effect element 248 located along the path of the light from the light source that is reflected from the flicker element 232 toward the screen 224. Preferably, the flame effect element 248 includes one or more apertures therein through which the reflected light is directed, for forming the light received on the screen into flame-like shapes or configurations. In Fig. 1B, the light from the light source 222 is schematically represented by arrow "2M", and the light reflected from one of the paddle elements 238 to the predetermined region 245 on the screen 224 is schematically represented by arrow "2N".

[0049] In Figs. 3A-3D, the middle part 247 is shown as being bent so that it is non-coplanar with the perimeter plane "2PR". As illustrated in Figs. 3A-3D, the side parts are coplanar with the perimeter plane "2PR". Other arrangements are illustrated in Figs. 3E and 3F. The flicker element 232 is rotated in the direction indicated by the arrow "H".

[0050] As can be seen in Fig. 3A, on the first side 254 of the body portion 240A, the central region 244' is somewhat convex. When the paddle element 238 is in the position shown in Fig. 3A, the light from the light source is at least partially directed to the slightly convex central region 244', and is reflected from the central region 244' toward the screen via the aperture(s) of the flame effect element 248 (not shown in Fig. 3A). It will be understood that the light is also reflected from the base regions 257A, 257B, however, such reflected light is omitted for clarity of illustration. In Fig. 3A, the light from the light source is schematically represented by the arrow "2Mi", and the light reflected from the central region 244' is schematically represented by the arrow "2Ni". The light from the light source 222 that is directed to the middle part 247 is also schematically represented by the arrow "F₁", and the light reflected from the middle part 247 is schematically represented by the arrow "G₁". It will also be understood that the reflected light "2Ni" and "G₁" is directed

through the aperture(s) of the flame effect element to the screen 224 (not shown in Figs. 3A-3D). The light that is reflected from the side parts is also omitted from Fig. 3A, for clarity of illustration.

[0051] In Fig. 3B, the rod 234 has rotated in the direction indicated by arrow "H" so that the paddle element 238 is in a different position (i.e., relative to its position illustrated in Fig. 3A) in respect of the light source 222. In Fig. 3B, the light from the light source 222 is schematically represented by the arrow "2M₂", and the reflected light is schematically represented by the arrow "2N₂". The light represented by the arrow "2M₂" is shown as being reflected from one or both of the side parts 249A, 249B. Because some of the light is reflected from the substantially planar side parts 249A, 249B, rather than the convex surface 244', the light reflected from the side parts 249A, 249B as projected onto the screen 224 would have a slightly different intensity than the light reflected from the central region 244'. The light from the light source that is directed to the middle part 247 is also schematically represented by the arrow "F₂", and the light reflected from the middle part 247 is schematically represented by the arrow "G₂". Due to the different positioning of the middle part 247 relative to the side parts 249A, 249B, the light reflected from the middle part 247 is directed toward a different location on the screen.

[0052] In Fig. 3C, the paddle element 238 is shown after it has been rotated further in the direction indicated by the arrow "H". In Fig. 3C, the second side 256 of the body portion 240B is exposed to the light from the light source 222. In this position, the light is also at least partially reflected from the central region 244", the light being represented by the arrows "2M₃" and "2N₃". The central region 244" on the second side 256 is concave. It will be understood that light is also reflected, at this point, from the base regions 257A, 257B, however, such reflected light is omitted for clarity of illustration. The light from the light source 222 that is directed to the middle part 247 is also schematically represented by the arrow "F₃", and the light reflected from the middle part 247 is schematically represented by the arrow "G₃". Due to the different positioning of the middle part 247 relative to the base regions 257A, 257B, the light reflected from the middle part 247 is directed toward a different location on the screen.

[0053] In Fig. 3D, the paddle element 238 is shown as having been rotated further in the direction indicated by the arrow "H" (relative to the position thereof illustrated in Fig. 3C), so that the light from the light source 222 is at least partially reflected from the substantially planar perimeter region 246". The light reflected from the base regions 257A, 257B is schematically represented by the arrow "2N₄". In this situation also, because the light is reflected from the substantially planar side parts 249A, 249B, rather than the concave surface 244", the light reflected from the side parts 249A, 249B as directed onto the screen 224 would have a slightly different intensity than the light reflected from the central region 244". The

light from the light source 222 that is directed to the middle part 247 is also schematically represented by the arrow "F₄", and the light reflected from the middle part 247 is schematically represented by the arrow "G₄". Due to the different positioning of the middle part 247 relative to the side parts 249A, 249B, the light reflected from the middle part 247 is directed toward a different location on the screen.

[0054] As noted above, the positions of the side parts 249A, 249B and the middle part 247 relative to each other may vary, depending on how the paddle element 238 bends when it is mounted on the mounting element. In Fig. 3E, on one of the body portions, the side parts and the middle part are shown as being non-coplanar with each other. The middle part and the two side parts are identified for convenience by reference numerals 247', 249A', and 249B' respectively.

[0055] As noted above, the middle part and the side parts may be substantially coplanar. This situation is illustrated in Fig. 3F, where only one side part is identified by reference numeral 249A" for convenience. It will be understood that the middle part and the other side part are not identified in Fig. 3F for clarity of illustration.

[0056] It will also be understood that, as described above, the flicker element preferably includes a number of paddle elements positioned along the rod body. The other paddle elements on the rod are omitted from Figs. 3A-3F for clarity of illustration. In addition, the locations of the middle part and the side parts relative to each other are exaggerated in Fig. 3E for clarity of illustration.

[0057] It is believed that the radial positioning of the paddle elements 238 relative to each other, to an extent, also causes the realistic variation in light intensity in the image 226 due to the different reflective surfaces of the body portions 240A, 240B being located to reflect the light from the light source(s) 222 in turn as the flicker element 232 is rotated about the rod's axis 236.

[0058] For example, in Fig. 4A, a top view of the situation illustrated in Fig. 3A is provided. The light from the light source 222 is represented by the arrow "2Mi", and as illustrated, it is reflected from the central region 244'. The light reflected from the central region 244' toward the screen 224 is represented by the arrow "2Ni". For clarity of illustration, the point on the central region 244' at which the light from the light source 222 is reflected toward the screen 224 is identified as "2X". As can be seen in Fig. 4A, the light that is reflected from the central region 244' produces an image of flames, or part thereof, at a point identified as "2Y" on the screen.

[0059] In Fig. 4B, a top view of the situation illustrated in Fig. 3B is provided. As can be seen in Figs. 3A and 3B, in Fig. 3B, the rod has rotated about its axis from the position illustrated in Fig. 3A. The light from the light source 222 is represented by the arrow "2M₂" and the light reflected from the middle part 247 is schematically represented by the arrow "2N₂". The light is shown as being reflected from a point "2V" on the middle part 247. As illustrated in Fig. 4B, the light that is reflected from

the perimeter region 246' is directed substantially orthogonally to the axis 236 of the rod 234, and intersects the screen at a point identified for clarity of illustration as "2Z".

[0060] In Fig. 4B, the light is schematically illustrated as being reflected from the middle part 247. As noted above, the form (i.e., planar or not) and position of the middle part (i.e., relative to the side parts) after mounting on the rod may vary from one paddle element to another. It will be understood that the middle element 247 is shown as being substantially planar in Fig. 4B for clarity of illustration.

[0061] From Figs. 4A and 4B, it can be seen that the different shapes of the central region 244 (i.e., non-planar) and the middle part 247 may result in the light from the light source 222 being reflected in slightly different directions toward the screen 224 as the rod 234 rotates. For clarity of illustration, the extent to which the locations "2Y" and "2Z" on the screen are different is exaggerated. It will be understood that a number of elements of the flame simulating assembly 220 are omitted from Figs. 4A and 4B, also for clarity of illustration. It will also be understood that the light reflected from the other central region 244", as illustrated in Fig. 3C, is also directed to a location on the screen that is other than the location on the screen to which the light reflected from the other side of the middle part 247 is directed.

[0062] Another benefit that is believed to result from the arrangement of the elements of the assembly 220 is the virtual elimination of incidental partially transverse flashes of light on the screen 224. This benefit is believed to be due to the generally consistent positioning of the paddle elements 238 relative to the screen 224, i.e., because the paddle elements 238 are positioned by the respective mounting elements 276 in the respective predetermined positions therefor. It will be understood that the rod 234 preferably is positioned so that its axis 236 is substantially parallel to the screen 224. The light from the light source is directed toward the body portions 240A, 240B in a direction that is substantially orthogonal to the axis 236, and aligned with an aperture in the flame effect element. It is believed that the elimination of the incidental partially transverse flashes of light is due to this arrangement, and the manner in which each paddle element is secured in position on each mounting element respectively.

[0063] As can be seen, for instance, in Figs. 1A and 1B, the flame simulating assembly 220 preferably also includes a simulated fuel bed 292. Those skilled in the art would appreciate that the simulated fuel bed 292 may be formed in any suitable manner, and made of any suitable materials. In one embodiment, the simulated fuel bed 292 preferably includes one or more simulated fuel elements 294 supported by a platform 296.

[0064] Those skilled in the art would also appreciate that the elements 294 may be made of any suitable material(s). The simulated fuel elements 294 preferably are at least partially light-transmitting. Preferably, the simulated fuel elements 294 are at least partially translucent,

and/or at least partially transparent. In one embodiment, it is preferred that the elements 294 are, for example, pieces of cut glass. Alternatively, the fuel elements 294 may be made of acrylic. The fuel elements 294 preferably are formed into any suitable shape(s). The fuel elements 294 preferably are located by the platform or support element 296 that positions at least some of the fuel elements 294 adjacent to the screen 224.

[0065] The fluctuations in the light that is reflected toward the screen are, in part, the result of the differences in forms and positioning of the parts and regions of the reflective surfaces 242, as illustrated schematically in Figs. 3A-3F, and as described above. In addition, the light that is reflected from the flicker element fluctuates in intensity because of the gaps between the paddle elements, i.e., each paddle element reflects the light only intermittently as the flicker element rotates.

[0066] Those skilled in the art would appreciate that, although the embodiments of methods of the invention as described above indicate that steps of the methods are to be performed in a sequence, certain of the steps may alternatively be performed in alternative sequences. For instance, in the method of providing images of flames, the elements of the flame simulating assembly generally may be provided in any suitable order.

[0067] It will be appreciated by those skilled in the art that the invention can take many forms, and that such forms are within the scope of the invention as claimed. The scope of the claims should not be limited by the preferred embodiments set forth in the examples, but should be given the broadest interpretation consistent with the description as a whole.

Claims

1. A flame simulating assembly (220) comprising:

at least one light source (222) for producing light;
a screen (224) to which the light from said at least one light source is directed, to provide a plurality of images of flickering flames (226) thereon;

a rotatable flicker element (232) comprising:

an elongate rod (234) defined by an axis (236) thereof about which the rod (232) is rotatable;

a plurality of paddle elements (238) located in respective predetermined locations on the rod, each said paddle element comprising at least one body portion (240) having at least one reflective surface (242) thereon, said at least one reflective surface comprising a central region (244) and a perimeter region (246) at least partially located around the central region (244), the perimeter region at least partially defining a perimeter

plane (2PR);
the paddle elements (238) being located in the respective predetermined locations therefor to position the perimeter plane (2PR) substantially perpendicular to the axis (236), for intermittently reflecting the light from said at least one light source (222) from said at least one reflective surface to predetermined regions (245) on the screen (224) respectively as the flicker element rotates about the axis, to provide the images of flickering flames on the screen (224); and

the central region (244) being substantially non-planar, having a first side and a second side, the central region on the first side being at least partially convex relative to the perimeter region on the first side and the central region on the second side being at least partially concave relative to the perimeter region on the second side, and the perimeter region being at least partially planar, to cause the light reflected therefrom to the screen (224) as the flicker element rotates to have varying intensity at the respective predetermined regions (245) on the screen (224),
characterized by:

the perimeter region (246) comprising at least one middle part (247) and at least one side part (249), said at least one middle part (247) being at least partially defined by at least one channel (253) partially separating said at least one middle part (247) and said at least one side part (249).

2. The flame simulating assembly according to claim 1 in which:

said at least one side part (249) comprises a first side part (249A) and a second side part (249B); said at least one channel (253) comprises first (253A) and second (253B) channels; and said at least one middle part (247) is at least partially defined by the first and second channels (253A, 253B), the first channel (253A) being located between said at least one middle part and the first side part, and the second channel (253B) being located between said at least one middle part and the second side part.

3. The flame simulating assembly according to claim 2 in which, in at least a selected one of the paddle elements, the first and second side parts are substantially coplanar relative to each other.

4. The flame simulating assembly according to claim 1 in which, in at least a selected one of the paddle elements, said at least one middle part is non-planar.

5. The flame simulating assembly according to claim 3 in which, in at least a selected one of the paddle elements, said at least one middle part is non-coplanar with said at least two side parts.

6. The flame simulating assembly according to claim 3 in which, in at least a selected one of the paddle elements, said at least two side parts and said at least one middle part are non-coplanar.

7. The flame simulating assembly according to claim 1 in which, in at least a selected one of the paddle elements, said at least one middle part and said at least one side part are substantially coplanar or are substantially non-coplanar.

8. A method of providing images of flames comprising:

providing at least one light source for producing light;

providing a rotatable flicker element comprising:

an elongate rod defined by an axis thereof;
a plurality of paddle elements located in respective predetermined locations on the rod, each said paddle element comprising at least one body portion with at least one reflective surface thereon, said at least one reflective surface being formed to comprise a substantially planar region at least partially defining a perimeter plane and a non-planar region forming a central region (244) of the paddle element, the central region (244) having a first side and a second side, the central region on the first side being at least partially convex relative to the perimeter region on the first side and the central region on the second side being at least partially concave relative to the perimeter region on the second side, and the perimeter region being at least partially planar, to cause the light reflected therefrom to the screen (224) as the flicker element rotates to have varying intensity at the respective predetermined regions (245) on the screen (224); and the perimeter region comprising at least one middle part and at least one side part, said at least one middle part being at least partially defined by at least one channel separating said at least one middle part and said at least one side part;
the paddle elements being located to position the perimeter plane substantially perpendicular to the axis;

providing a screen for displaying a plurality of images of flames thereon;
positioning the rod with the axis thereof substan-

tially parallel to the screen, to locate said at least one reflective surface on each of the paddle elements intermittently in a path of the light from said at least one light source as the rod rotates about the axis, for reflecting the light from said at least one light source to the screen as the flicker element rotates relative to the screen; rotating the flicker element about the axis; and when the flicker element is rotating, directing the light from said at least one light source to said at least one reflective surface intermittently, to intermittently provide a first reflected light reflected from said at least one middle part, a second reflected light reflected from said at least one side part, and a third reflected light reflected from the non-planar region to the screen to provide the images of flames, said images comprising respective portions thereof formed by the first reflected light and the second reflected light and the third reflected light, the first reflected light and the second reflected light having a different intensity on the screen relative to the third reflected light.

Patentansprüche

1. Flammensimulationsanordnung (220), umfassend:

mindestens eine Lichtquelle (222) zum Erzeugen von Licht;
einen Bildschirm (224), auf den das Licht aus der mindestens einen Lichtquelle gerichtet wird, um eine Mehrzahl von Bildern von flackernden Flammen (226) darauf bereitzustellen;
ein drehbares Flackerelement (232), umfassend:

eine längliche Stange (234), die durch eine Achse (236) davon definiert ist, um welche die Stange (232) drehbar ist;
eine Mehrzahl von Paddелеlementen (238), die an jeweiligen vorbestimmten Positionen an der Stange angeordnet sind, wobei jedes Paddелеlement mindestens einen Körperabschnitt (240) mit mindestens einer reflektierenden Fläche (242) darauf aufweist, wobei die mindestens eine reflektierende Fläche einen Zentralbereich (244) und einen Umfangsbereich (246) umfasst, der zumindest teilweise um den Zentralbereich (244) herum angeordnet ist, wobei der Umfangsbereich zumindest teilweise eine Umfangsebene (2PR) definiert;
wobei die Paddелеlemente (238) an den jeweiligen vorbestimmten Positionen dafür angeordnet sind, um die Umfangsebene (2PR) im Wesentlichen rechtwinkelig zu der

Achse (236) zu positionieren, um intermittierend das Licht aus der mindestens einen Lichtquelle (222) von der mindestens einen reflektierenden Fläche entsprechend auf vorbestimmte Bereiche (245) auf dem Bildschirm (224) zu reflektieren, während sich das Flackerelement um die Achse dreht, um die Bilder von flackernden Flammen auf dem Bildschirm (224) bereitzustellen; und

wobei der Zentralbereich (244) im Wesentlichen nicht eben ist und eine erste Seite und eine zweite Seite aufweist, wobei der Zentralbereich an der ersten Seite zumindest teilweise konvex in Bezug auf den Umfangsbereich an der ersten Seite ist und der Zentralbereich an der zweiten Seite zumindest teilweise konkav in Bezug auf den Umfangsbereich an der zweiten Seite ist, und wobei der Umfangsbereich zumindest teilweise eben ist, um zu bewirken, dass das davon auf den Bildschirm (224) reflektierte Licht beim Drehen des Flackerelements eine variierende Intensität auf den jeweiligen vorbestimmten Bereichen (245) auf dem Bildschirm (224) aufweist, **dadurch gekennzeichnet, dass:**

der Umfangsbereich (246) mindestens einen Mittelteil (247) und mindestens einen Seitenteil (249) umfasst, wobei der mindestens eine Mittelteil (247) zumindest teilweise durch mindestens einen Kanal (253) definiert ist, der den mindestens einen Mittelteil (247) und den mindestens einen Seitenteil (249) teilweise trennt.

2. Flammensimulationsanordnung nach Anspruch 1, wobei:

der mindestens eine Seitenteil (249) einen ersten Seitenteil (249A) und einen zweiten Seitenteil (249B) umfasst;
der mindestens eine Kanal (253) einen ersten (253A) und einen zweiten (253B) Kanal umfasst; und
der mindestens eine Mittelteil (247) zumindest teilweise durch den ersten und den zweiten Kanal (253A, 253B) definiert ist, wobei der erste Kanal (253A) zwischen dem mindestens einen Mittelteil und dem ersten Seitenteil angeordnet ist und der zweite Kanal (253B) zwischen dem mindestens einen Mittelteil und dem zweiten Seitenteil angeordnet ist.

3. Flammensimulationsanordnung nach Anspruch 2, wobei in mindestens einem ausgewählten der Paddелеlemente der erste und der zweite Seitenteil im Wesentlichen koplanar in Bezug aufeinander sind.

4. Flammensimulationsanordnung nach Anspruch 1, wobei in mindestens einem ausgewählten der Pad-

delelemente der mindestens eine Mittelteil nicht eben ist.

5. Flammensimulationsanordnung nach Anspruch 3, wobei in mindestens einem ausgewählten der Paddetelemente der mindestens eine Mittelteil nicht koplanar mit den mindestens zwei Seitenteilen ist. 5
6. Flammensimulationsanordnung nach Anspruch 3, wobei in mindestens einem ausgewählten der Paddetelemente die mindestens zwei Seitenteile und der mindestens eine Mittelteil nicht koplanar sind. 10
7. Flammensimulationsanordnung nach Anspruch 1, wobei in mindestens einem ausgewählten der Paddetelemente der mindestens eine Mittelteil und der mindestens eine Seitenteil im Wesentlichen koplanar sind oder im Wesentlichen nicht koplanar sind. 15
8. Verfahren zum Bereitstellen von Bildern von Flammen, umfassend: 20

Bereitstellen mindestens einer Lichtquelle zum Erzeugen von Licht;

Bereitstellen eines drehbaren Flackerelements, umfassend: 25

eine längliche Stange, die durch eine Achse davon definiert ist;

eine Mehrzahl von Paddetelementen, die an jeweiligen vorbestimmten Positionen an der Stange angeordnet sind, wobei jedes Paddetelement mindestens einen Körperabschnitt mit mindestens einer reflektierenden Fläche darauf aufweist, wobei die mindestens eine reflektierende Fläche derart ausgebildet ist, dass sie einen im Wesentlichen ebenen Bereich umfasst, der zumindest teilweise eine Umfangsebene definiert, und einen nicht ebenen Bereich, der einen Zentralbereich (244) des Paddetelements bildet, wobei der Zentralbereich (244) eine erste Seite und eine zweite Seite aufweist, wobei der Zentralbereich an der ersten Seite zumindest teilweise konvex in Bezug auf den Umfangsbereich an der ersten Seite ist und der Zentralbereich an der zweiten Seite zumindest teilweise konkav in Bezug auf den Umfangsbereich an der zweiten Seite ist, und wobei der Umfangsbereich zumindest teilweise eben ist, um zu bewirken, dass das davon auf den Bildschirm (224) reflektierte Licht beim Drehen des Flackerelements eine variierende Intensität auf den jeweiligen vorbestimmten Bereichen (245) auf dem Bildschirm (224) aufweist; 30 35 40 45 50

und wobei der Umfangsbereich mindestens

einen Mittelteil und mindestens einen Seitenteil umfasst, wobei der mindestens eine Mittelteil zumindest teilweise durch mindestens einen Kanal definiert ist, der den mindestens einen Mittelteil und den mindestens einen Seitenteil trennt; wobei die Paddetelemente derart angeordnet sind, dass sie die Umfangsebene im Wesentlichen rechtwinkelig zu der Achse positionieren;

Bereitstellen eines Bildschirms zum Anzeigen einer Mehrzahl von Bildern von Flammen darauf;

Positionieren der Stange mit der Achse davon im Wesentlichen parallel zu dem Bildschirm, um die mindestens eine reflektierende Fläche auf jedem der Paddetelemente intermittierend in einem Weg des Lichts aus der mindestens einen Lichtquelle anzuordnen, während sich die Stange um die Achse dreht, um das Licht aus der mindestens einen Lichtquelle auf den Bildschirm zu reflektieren, während sich das Flackerelement in Bezug auf den Bildschirm dreht; Drehen des Flackerelements um die Achse; und wenn sich das Flackerelement dreht, intermittierendes Richten des Lichts aus der mindestens einen Lichtquelle auf die mindestens eine reflektierende Fläche, um intermittierend ein erstes reflektiertes Licht bereitzustellen, das von dem mindestens einen Mittelteil reflektiert wird, ein zweites reflektiertes Licht, das von dem mindestens einen Seitenteil reflektiert wird, und ein drittes reflektiertes Licht, das von dem nicht ebenen Bereich reflektiert wird, auf den Bildschirm, um die Bilder von Flammen bereitzustellen, wobei die Bilder jeweilige Abschnitte davon umfassen, die durch das erste reflektierte Licht und das zweite reflektierte Licht und das dritte reflektierte Licht gebildet werden, wobei das erste reflektierte Licht und das zweite reflektierte Licht eine unterschiedliche Intensität auf dem Bildschirm in Bezug auf das dritte reflektierte Licht aufweisen.

Revendications

1. Ensemble de simulation de flamme (220) comprenant :

au moins une source de lumière (222) pour produire de la lumière ;
un écran (224) vers lequel la lumière de ladite au moins une source de lumière est dirigée, pour fournir une pluralité d'images de flammes scintillantes (226) sur celui-ci ;
un élément de papillotement rotatif (232)

comprenant :

une tige allongée (234) définie par un axe (236) de celle-ci autour duquel la tige (232) peut tourner ;
 une pluralité d'éléments de palette (238) situés dans des emplacements prédéterminés respectifs sur la tige, chaque dit élément de palette comprenant au moins une partie de corps (240) ayant au moins une surface réfléchissante (242) sur celle-ci, ladite au moins une surface réfléchissante comprenant une région centrale (244) et une région périmétrique (246) au moins partiellement situées autour de la région centrale (244), la région périmétrique définissant au moins partiellement un plan périmétrique (2PR) ;
 les éléments de palette (238) étant situés dans leurs emplacements respectifs prédéterminés pour positionner le plan de périmètre (2PR) sensiblement perpendiculairement à l'axe (236), pour réfléchir par intermittence la lumière provenant de ladite au moins une source de lumière (222) respectivement de ladite au moins une surface réfléchissante à des régions prédéterminées (245) sur l'écran (224) lorsque l'élément de papillotement tourne autour de l'axe, pour fournir les images de flammes scintillantes sur l'écran (224) ; et

la région centrale (244) étant sensiblement non plane, ayant un premier côté et un second côté, la région centrale sur le premier côté étant au moins partiellement convexe par rapport à la région périmétrique sur le premier côté et la région centrale sur le second côté étant au moins partiellement concave par rapport à la région périmétrique sur le second côté et la région périmétrique étant au moins partiellement plane, pour provoquer la réflexion de la lumière de celle-ci sur l'écran (224) lorsque l'élément de papillotement tourne pour avoir une intensité variable aux régions prédéterminées respectives (245) sur l'écran (224), **caractérisées par :**

la région périmétrique (246) comprenant au moins une partie médiane (247) et au moins une partie latérale (249), ladite au moins une partie médiane (247) étant au moins partiellement définie par au moins un canal (253) séparant partiellement lesdits au moins une partie médiane (247) et ladite au moins une partie latérale (249).

2. Ensemble de simulation de flamme selon la revendication 1, dans lequel :

ladite au moins une partie latérale (249) com-

prend une première partie latérale (249A) et une seconde partie latérale (249B) ;
 ledit au moins un canal (253) comprend des premier (253A) et second (253B) canaux ; et
 ladite au moins une partie médiane (247) est au moins partiellement définie par les premier et second canaux (253A, 253B), le premier canal (253A) étant situé entre ladite au moins une partie médiane et la première partie latérale et le second le canal (253B) étant situé entre ladite au moins une partie médiane et la seconde partie latérale.

3. Ensemble de simulation de flamme selon la revendication 2, dans lequel, dans au moins un élément sélectionné parmi les éléments de palette, les première et seconde parties latérales sont sensiblement coplanaires l'une par rapport à l'autre.
4. Ensemble de simulation de flamme selon la revendication 1, dans lequel, dans au moins un élément sélectionné parmi les éléments de palette, ladite au moins une partie médiane n'est pas plane.
5. Ensemble de simulation de flamme selon la revendication 3, dans lequel, dans au moins un élément sélectionné parmi les éléments de palette, ladite au moins une partie médiane n'est pas coplanaire avec lesdites au moins deux parties latérales.
6. Ensemble de simulation de flamme selon la revendication 3, dans lequel, dans au moins un élément sélectionné parmi les éléments de palette, lesdites au moins deux parties latérales et ladite au moins une partie médiane ne sont pas coplanaires.
7. Ensemble de simulation de flamme selon la revendication 1, dans lequel, dans au moins un élément sélectionné parmi les éléments de palette, lesdites au moins une partie médiane et ladite au moins une partie latérale sont sensiblement coplanaires ou sensiblement non coplanaires.
8. Procédé pour fournir des images de flammes comprenant :

la fourniture d'au moins une source de lumière (222) pour produire de la lumière ;
 la fourniture d'un élément de papillotement rotatif (232) comprenant :

une tige allongée (234) définie par un axe (236) de celle-ci ;
 une pluralité d'éléments de palette situés dans des emplacements prédéterminés respectifs sur la tige, chaque dit élément de palette comprenant au moins une partie de corps avec au moins une surface réfléchis-

sante sur celle-ci, ladite au moins une surface réfléchissante étant formée pour comprendre une région sensiblement plane définissant au moins partiellement un plan périmétrique et une région non plane formant une région centrale (244) de l'élément de palette, la région centrale (244) ayant un premier côté et un second côté, la région centrale du premier côté étant au moins partiellement convexe par rapport à la région périmétrique sur le premier côté et la région centrale sur le second côté étant au moins partiellement concave par rapport à la région périmétrique sur le second côté, et la région périmétrique étant au moins partiellement plane, pour provoquer la réflexion de la lumière de celle-ci sur l'écran (224) lorsque l'élément de papillotement tourne pour avoir une intensité variable au niveau des régions prédéterminées respectives (245) sur l'écran (224) ;

et la région périmétrique comprenant au moins une partie médiane et au moins une partie latérale, ladite au moins une partie médiane étant au moins partiellement définie par au moins un canal séparant ladite au moins une partie médiane et ladite au moins une partie latérale ;

les éléments de palette étant situés pour positionner le plan de périmètre sensiblement perpendiculairement à l'axe ;

la fourniture d'un écran destiné à afficher une pluralité d'images de flammes sur celui-ci ;

le positionnement de la tige avec son axe sensiblement parallèle à l'écran, pour localiser ladite au moins une surface réfléchissante sur chacun des éléments de palette par intermittence dans un trajet de la lumière provenant de ladite au moins une source de lumière lorsque la tige tourne autour de l'axe, pour la réflexion de la lumière depuis ladite au moins une source de lumière vers l'écran lorsque l'élément de papillotement tourne par rapport à l'écran ;

la rotation de l'élément de papillotement autour de l'axe ; et

lorsque l'élément de papillotement, la direction de la lumière de ladite au moins une source de lumière vers ladite au moins une surface réfléchissante par intermittence, pour fournir par intermittence une première lumière réfléchie réfléchie par ladite au moins une partie médiane, une deuxième lumière réfléchie réfléchie par ladite au moins une partie latérale et une troisième lumière réfléchie réfléchie par la région non plane vers l'écran pour fournir les images

de flammes, lesdites images comprenant des parties respectives de celles-ci formées par la première lumière réfléchie, la deuxième lumière réfléchie et la troisième lumière réfléchie, la première lumière réfléchie et la deuxième lumière réfléchie ayant une intensité différente sur l'écran par rapport à la troisième lumière réfléchie.

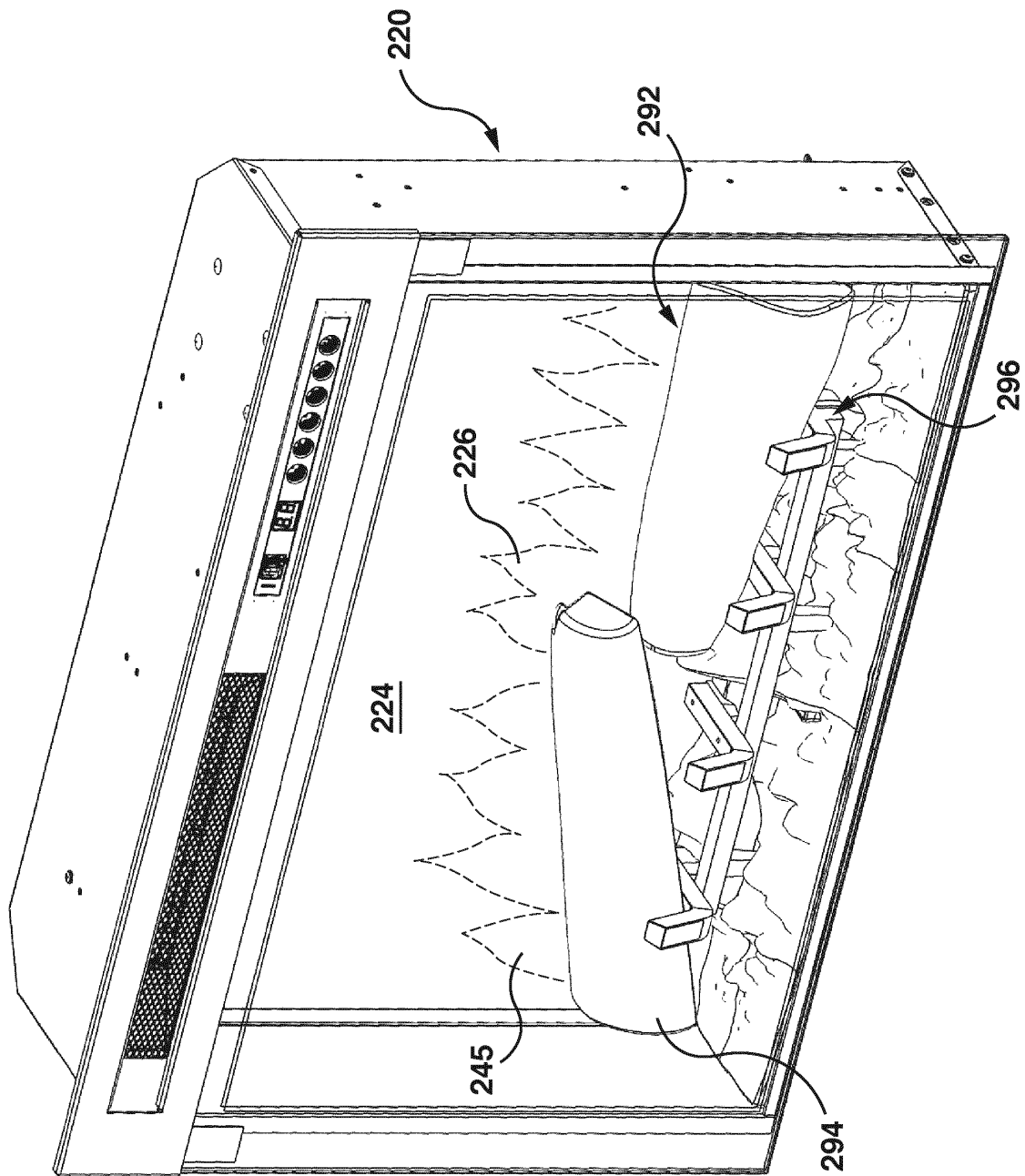


Fig. 1A

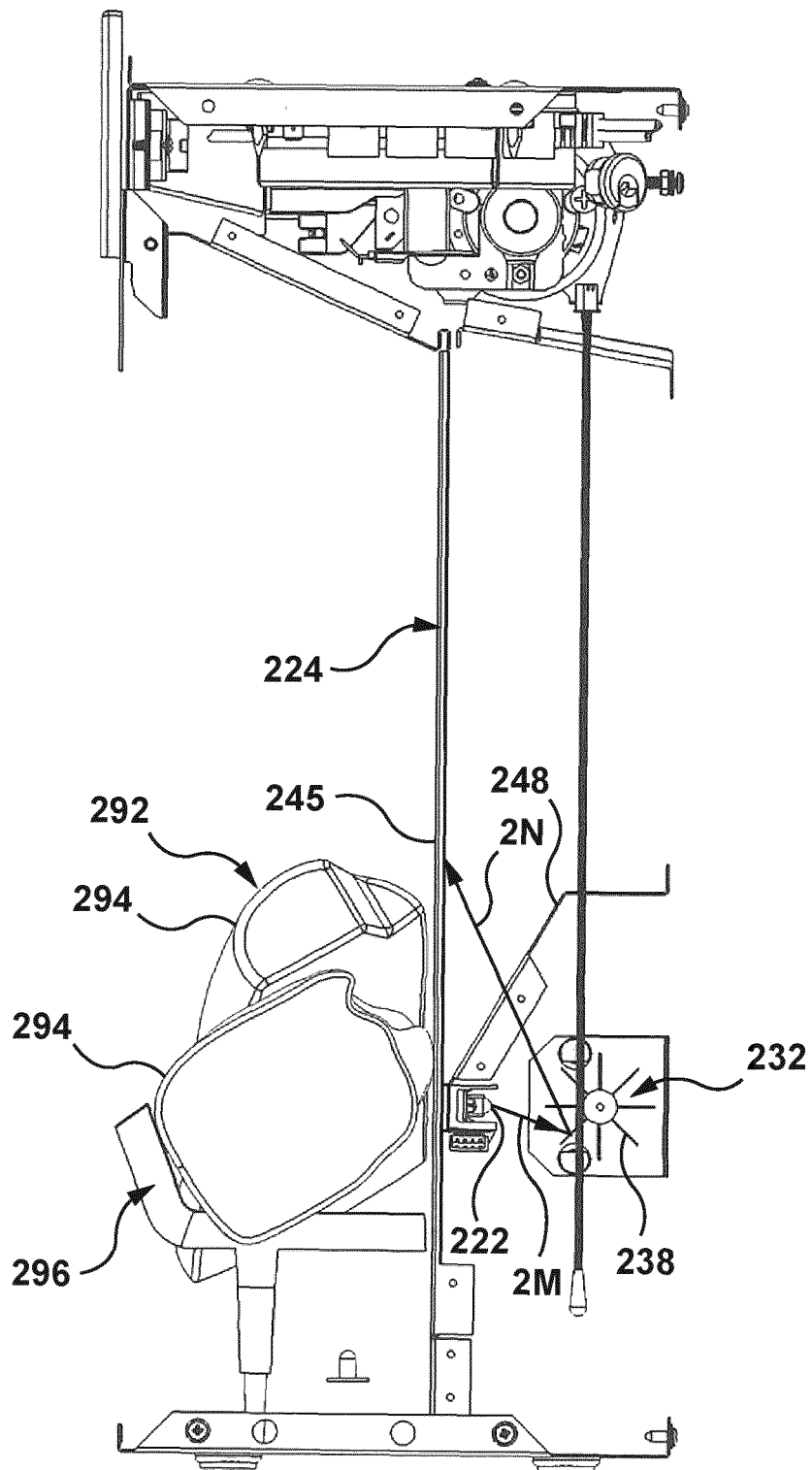


Fig. 1B

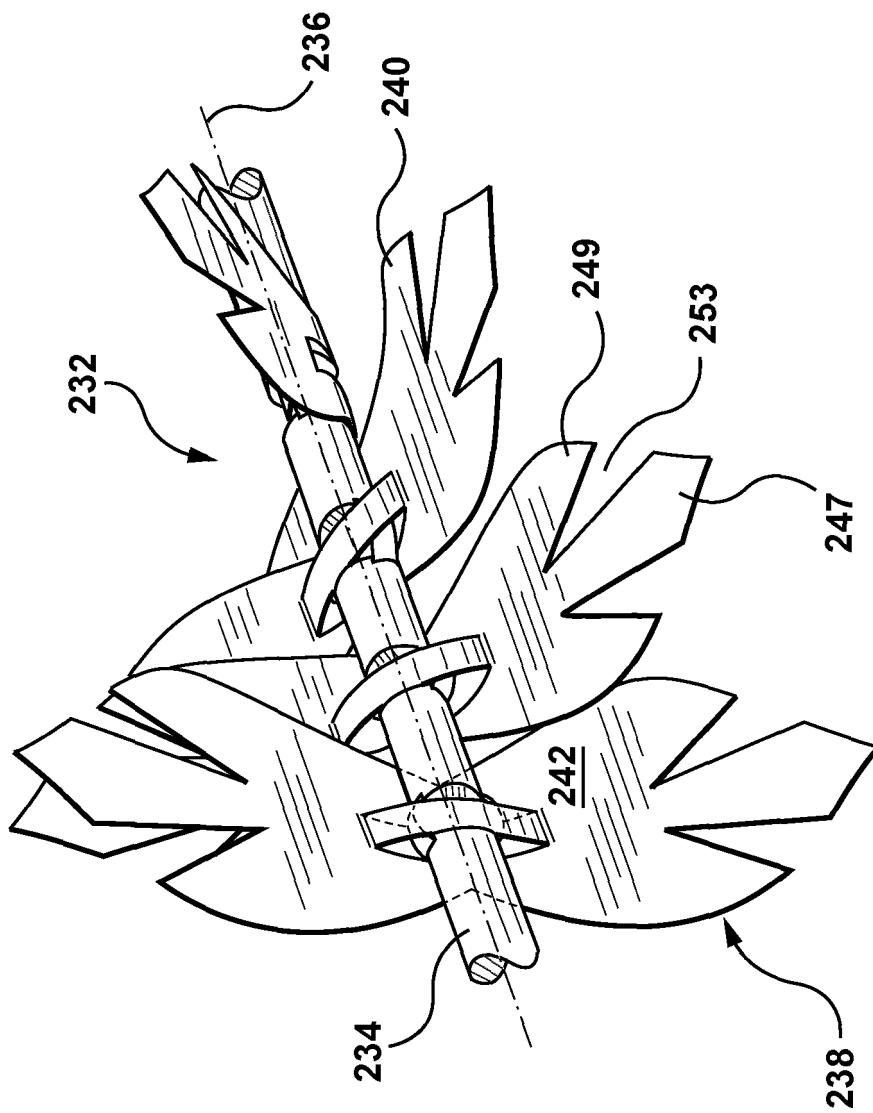


Fig. 1C

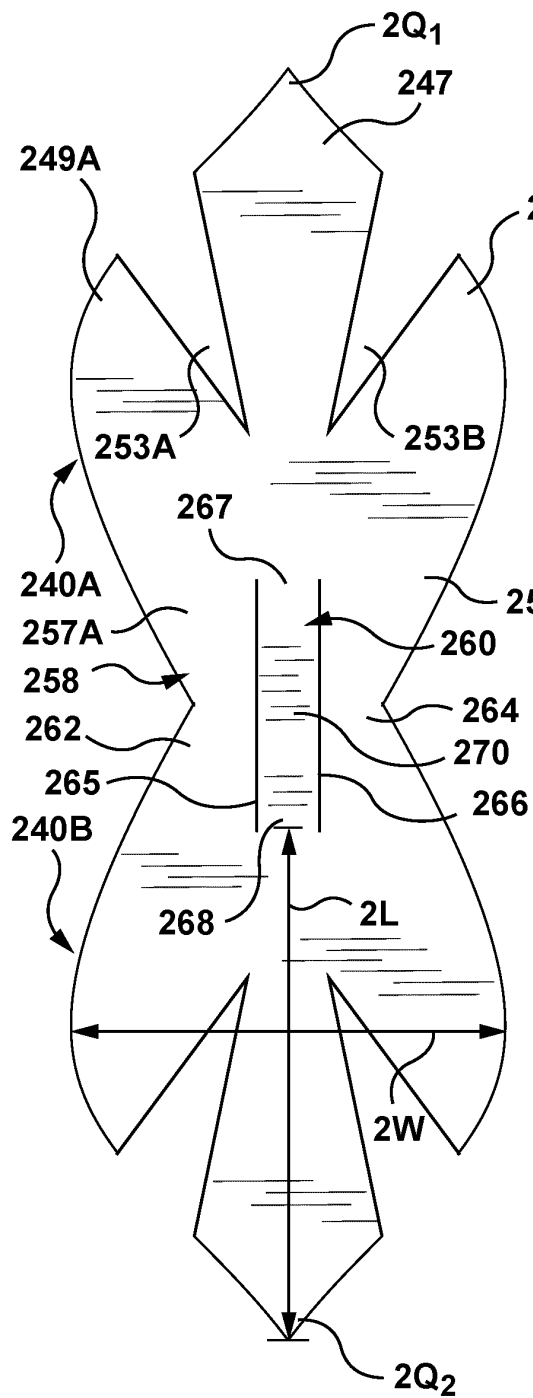


Fig. 2A

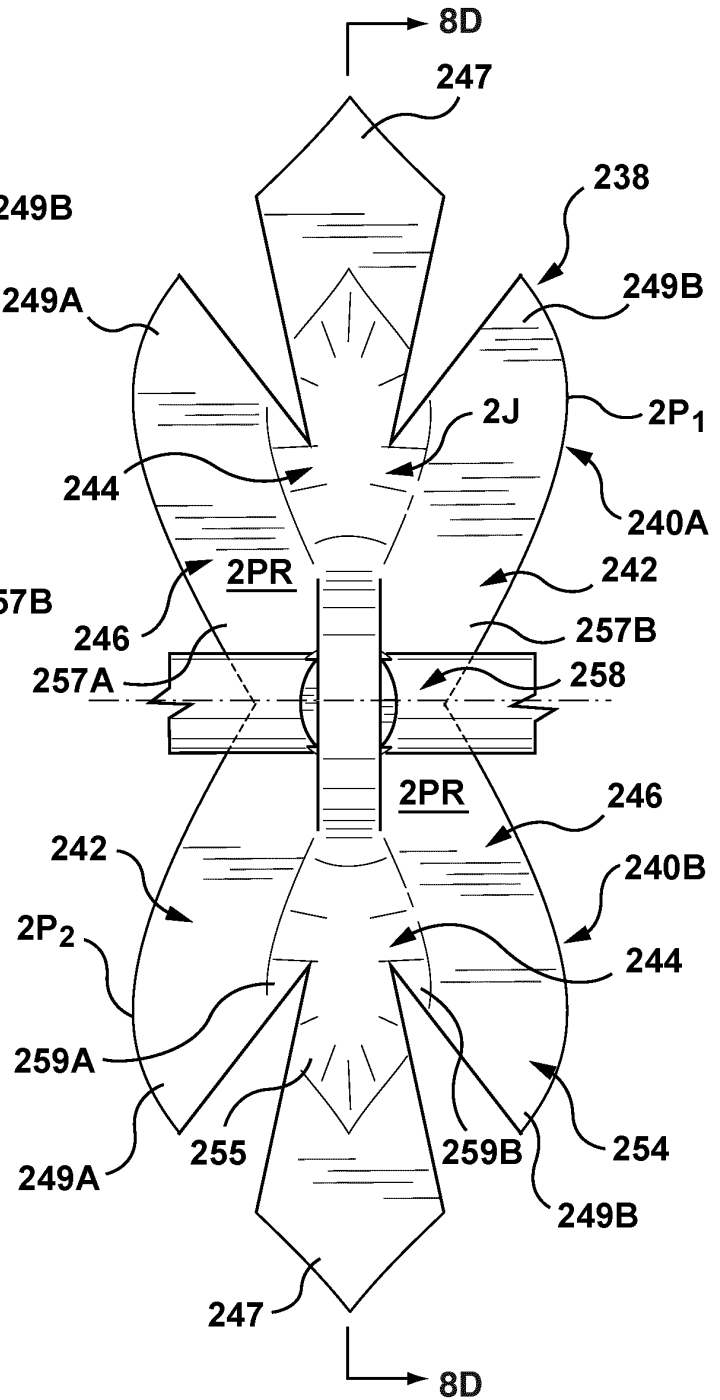


Fig. 2B

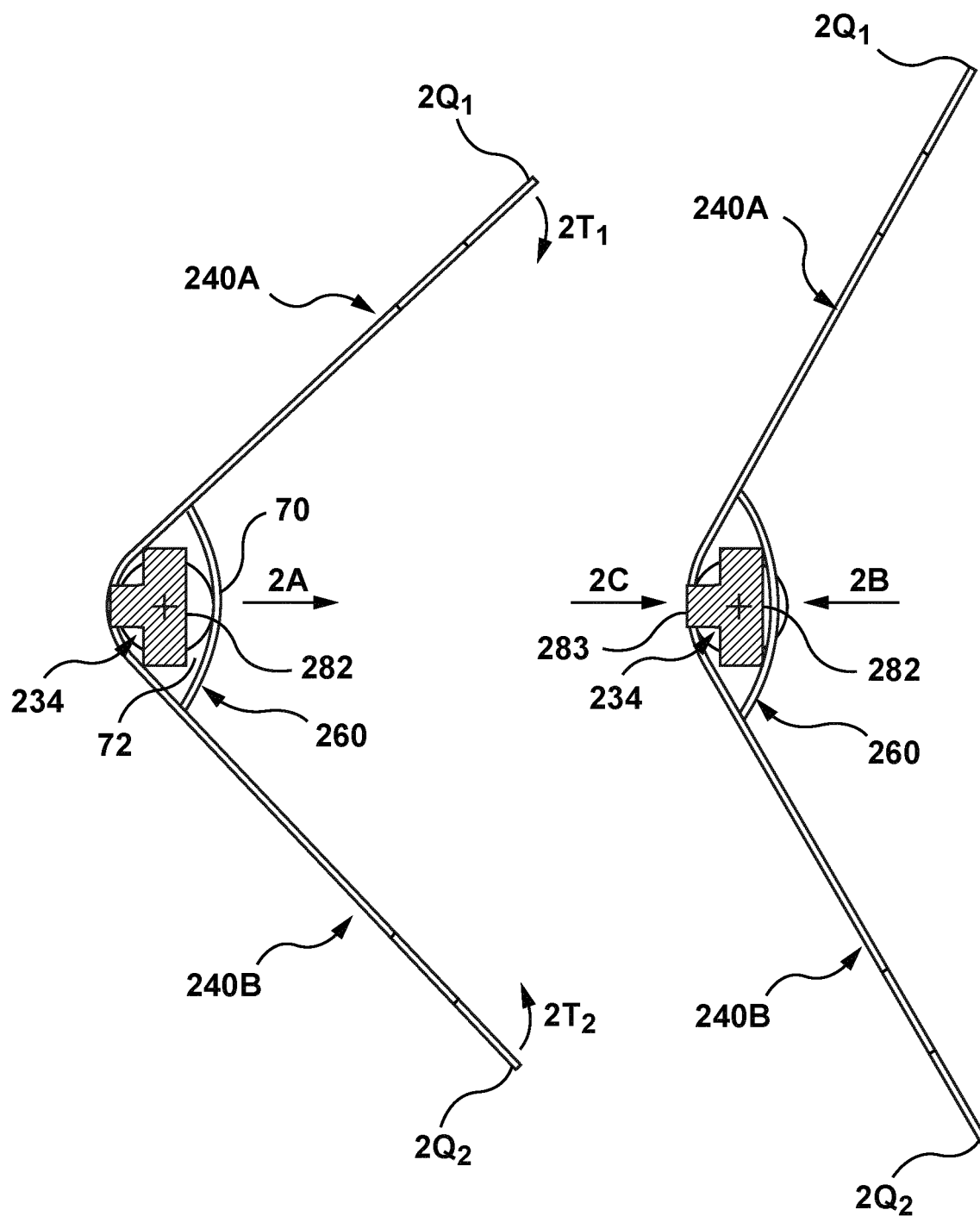


Fig. 2C

Fig. 2D

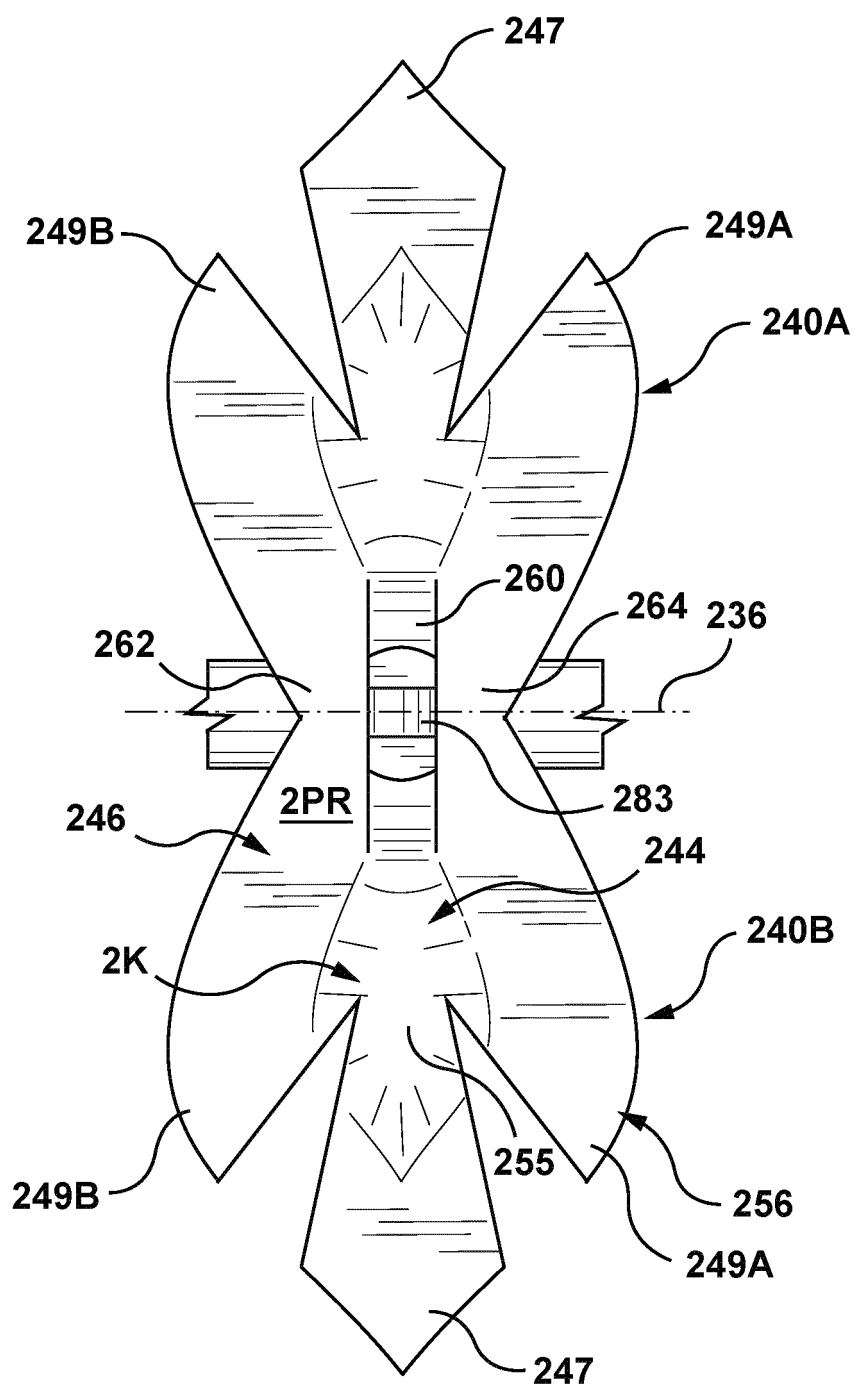


Fig. 2E

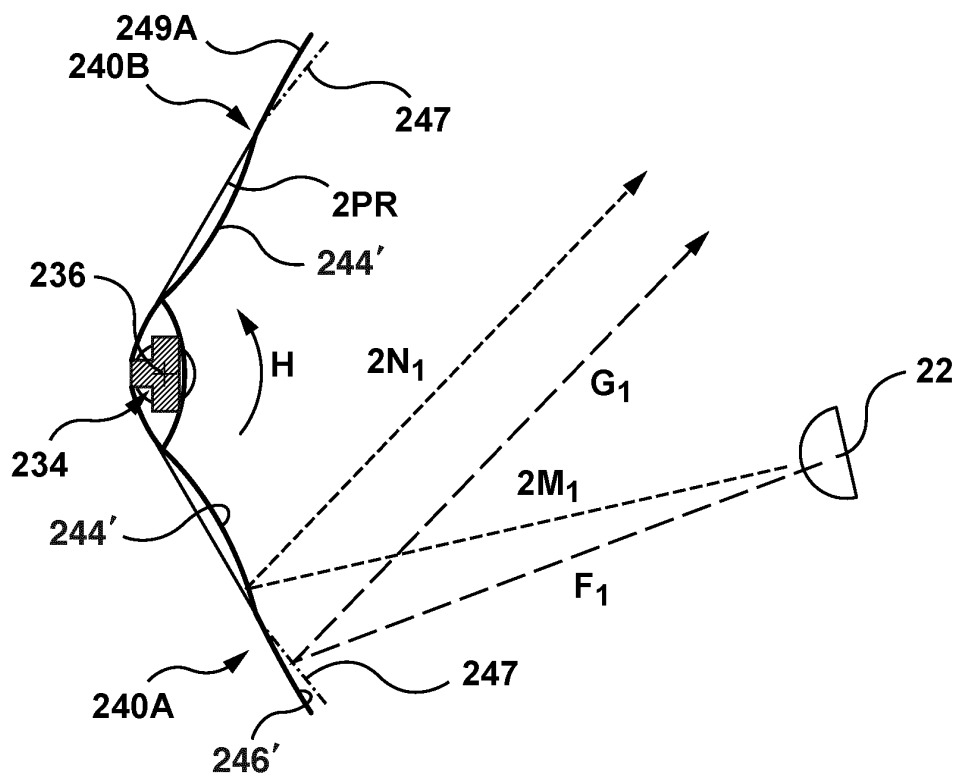


Fig. 3A

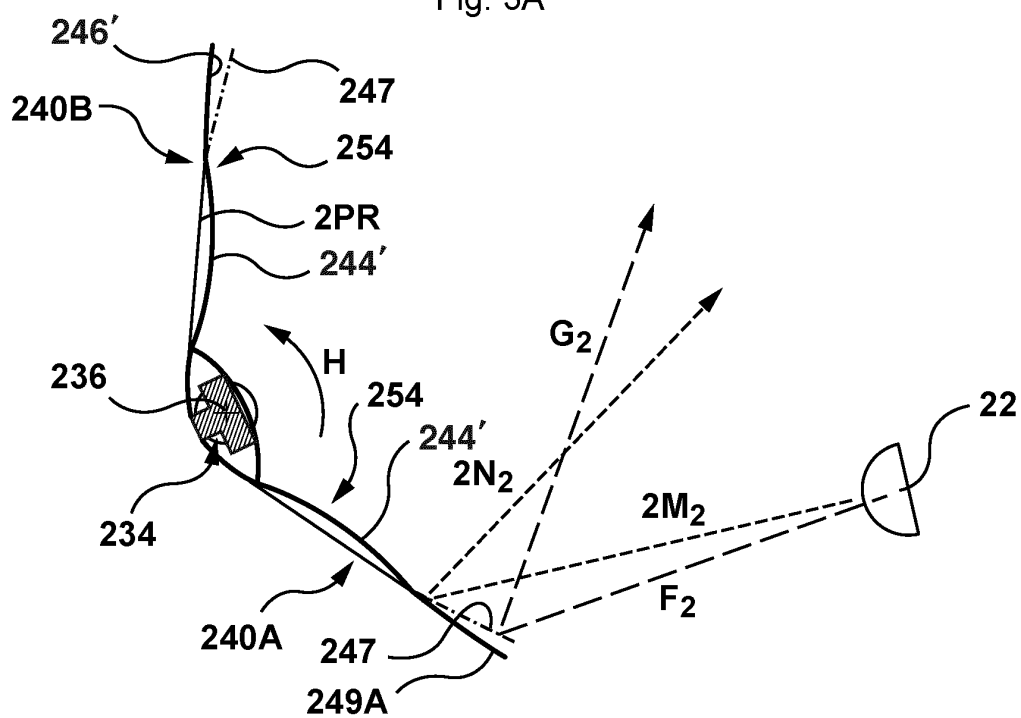


Fig. 3B

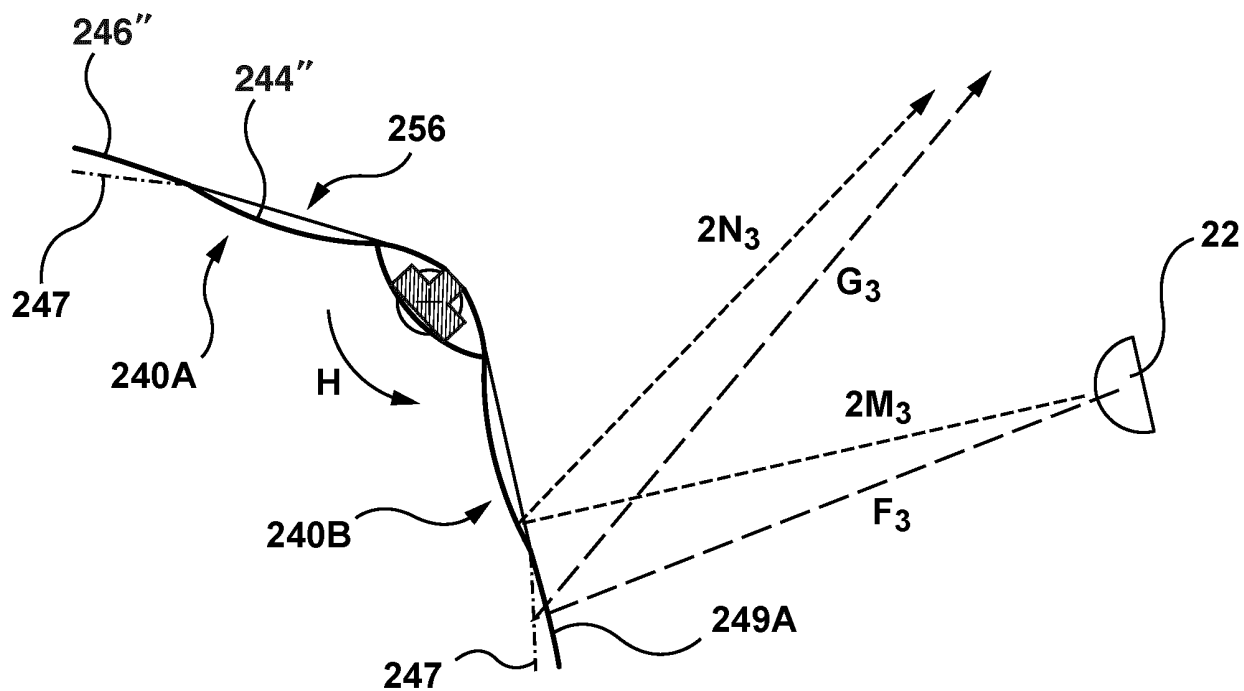


Fig. 3C

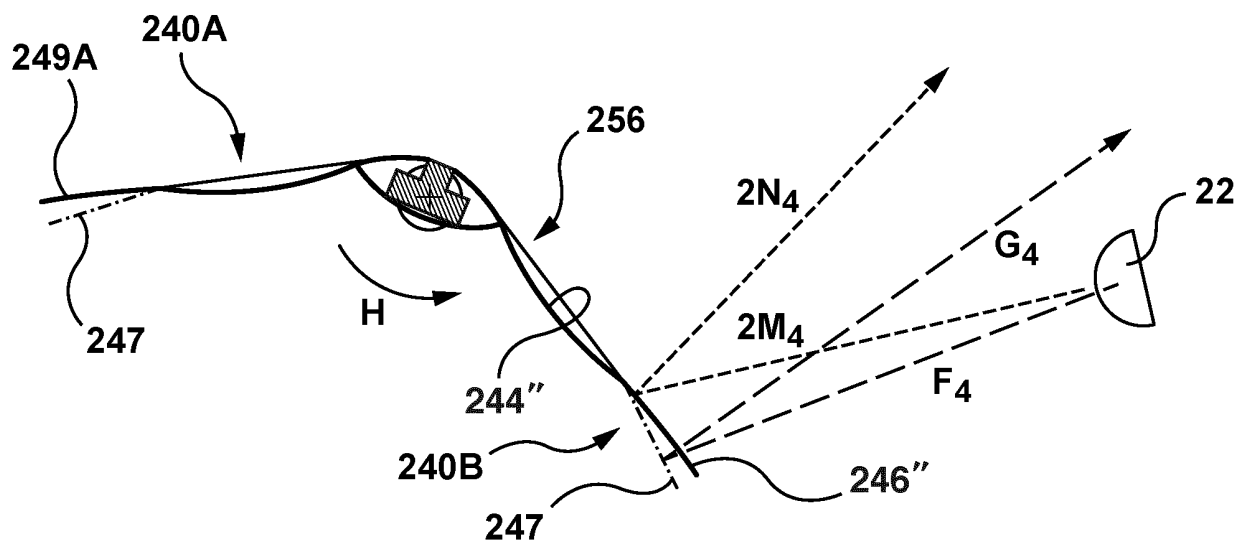


Fig. 3D

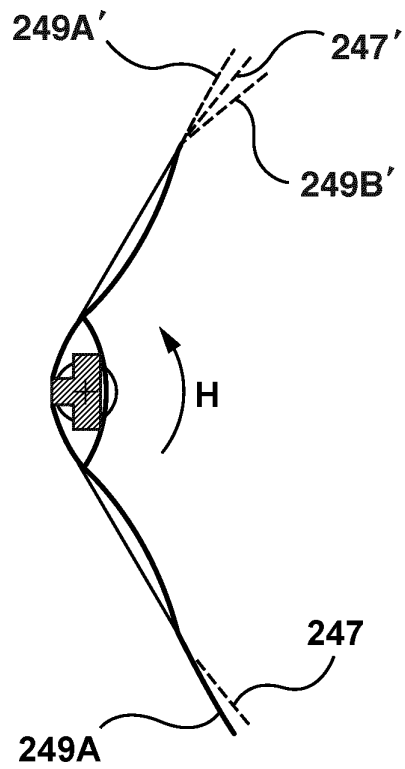


Fig. 3E

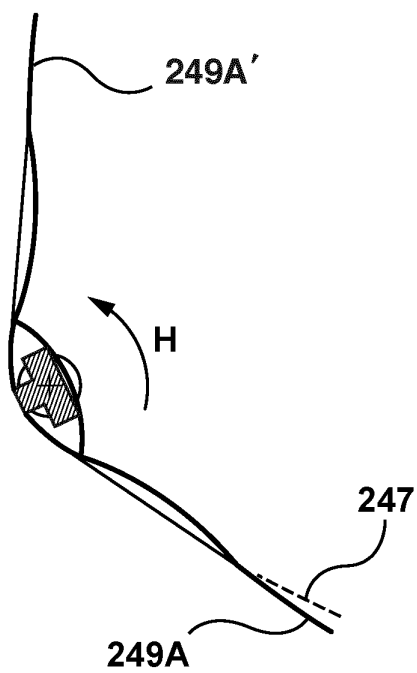


Fig. 3F

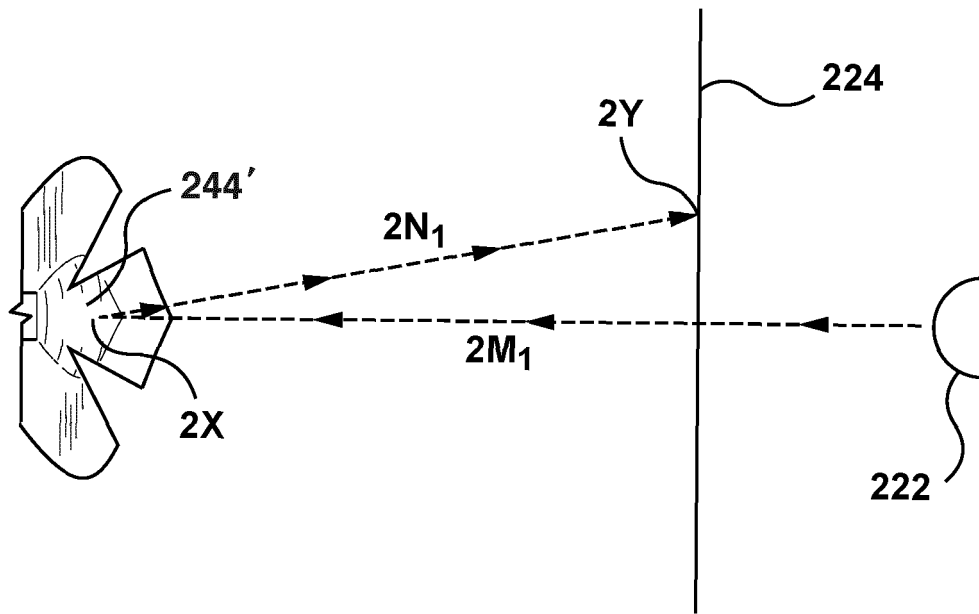


Fig. 4A

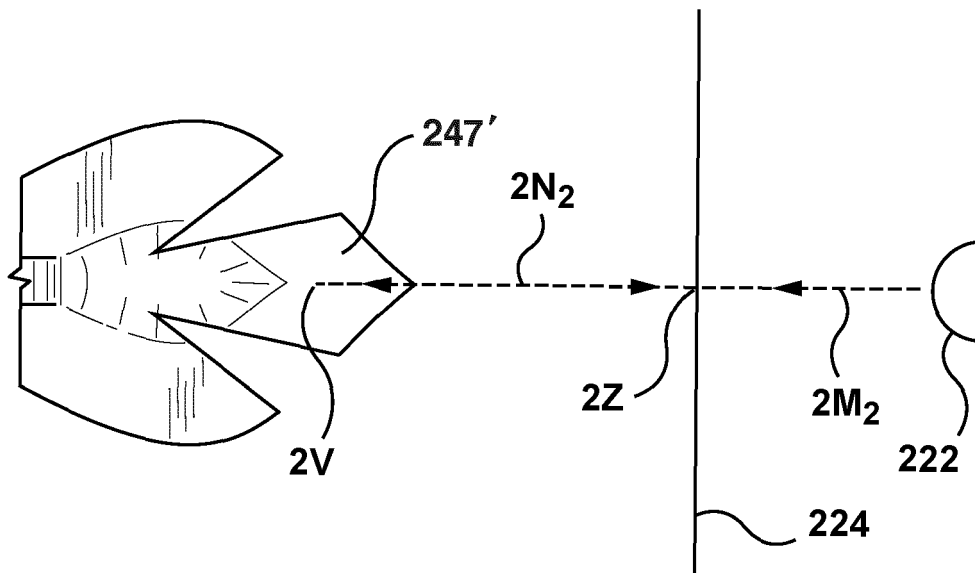


Fig. 4B

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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