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(54) **FLAME SIMULATING ASSEMBLY.**

VORRICHTUNG ZUM SIMULIEREN VON FLAMMEN.

AGENCEMENT SIMULANT DES FLAMMES.

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Description

Field of the Invention

[0001] The present invention relates generally to simulated fireplaces and, more particularly, to fireplace assemblies providing an image of a rear firewall or the like.

[0002] According to the invention, there is provided a fireplace assembly comprising:

a substantially transparent front wall having a rear surface and a front surface;
a reflective surface spaced from and facing said rear surface of said front wall; characterised in that an image is applied to said rear surface of said front wall, said image being substantially invisible to an observer looking through said front surface other than as a reflected image in said reflective surface.

Brief Description of the Drawings

[0003] For a better understanding of the present invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings. The drawings show preferred embodiments of the present invention, in which:

Figure 1 is a perspective view of an electric fireplace incorporating a fire wall simulating assembly;
Figure 2 is a side view of one form of flame simulating assembly which may be incorporated in the fireplace of the invention;
Figure 3 is a side view of a further form of flame simulating assembly which may be incorporated into the fireplace of the invention; and
Figure 4 is an enlarged perspective view of the inner surface of the front wall of the fireplace according to Figure 1.

[0004] A fireplace assembly in accordance with the present invention is shown generally at 10 in the figures. The assembly is incorporated within an electric fireplace which is depicted generally at 12 with an electrical connection 13 *for* connecting to a power source (not shown).

[0005] The electric fireplace 12 includes a housing 14 that defines a simulated firebox having top, bottom, front, rear and side walls 16, 18, 20, 22 and 23, respectively. A portion of the front wall is defined by a transparent front panel 24 that is removable to permit access to the contents of the housing 14. A control unit 21 is located above the top wall of the housing. The control unit 21 includes a heater unit 25, a thermostat 27 for controlling the heat output and a main power switch 29 for actuating the flame effect

[0006] Referring to Figure 2, a simulated fuel bed 26 is supported on a platform 28 located at a lower front portion of the housing 14. The fuel bed 26 comprises a plastic shell that is vacuum formed and colored to resemble logs and embers for a log burning fire.

[0007] Portions of the shell are translucent to permit light from a light source 30 located beneath the fuel bed 26 to shine through. For instance, the shell may be formed from an orange translucent plastic. The top side of the plastic shell may be painted in places to resemble the surface of logs. The underside of the plastic shell may be painted black (or some other opaque color) and then sanded in portions where it is desired for light to pass. For instance, the protruding points on the underside of the shell (corresponding to indents in the top side) may be sanded to allow light passage. These points would thus resemble the embers of a fire. Also, the crotch area between simulated logs may be sanded (or left unpainted) to resemble embers at the intersection of two logs.

[0008] In the embodiment shown in Figure 2, the light source 30 comprises three 60 watt light bulbs that are supported in sockets 34 below the fuel bed 26. Alternatively, one or more quartz halogen lights may be utilized. The sockets 34 are supported by vertical arms 36 that are connected with fasteners 38 to the bottom wall of the housing 14. A parabolic reflector 40 is located below the light source 30 at the lower front end of the housing 14 to direct light toward the rear of the housing 14. The intensity of the light can be varied with a dimmer switch 41 that is electrically connected to the light source 30 and located on the control unit 21.

[0009] Located immediately behind the fuel bed 26 is a vertical screen 42. The screen 42 is transparent and has a partially reflecting surface 44 and a diffusing surface 46. The screen 42 is seated in a groove 48 defined in a lower horizontal support member 50. the lower horizontal support member 50 is fastened to the side walls 23 of the housing 14 with fasteners 52. The screen 42 is supported on its sides with side frame members 54 that are fastened to the side walls 23 with fasteners 56. The screen structure is described in more detail in US Patent 4,965,707.

[0010] The screen 42 is positioned immediately behind the fuel bed 26 so that the fuel bed 26 will be reflected in the reflecting surface 44 to give the illusion of depth. As will be explained further below, the image of simulated flames appears to be emanating from between the fuel bed 26 and the reflection of the fuel bed 26 in the screen. Also, simulated flames appear to be emanating from the reflected image of the fuel bed 26. An upper light source 57 is located at the top front portion of the housing for illuminating the top of the simulated fuel bed 26 and enhancing the reflected image in the screen 42.

[0011] Referring more closely to the flame simulation assembly 10, the assembly includes a flame effect element 58, a blower 60 and upper and lower flicker elements 62 and 64.

[0012] In the embodiment illustrated in Figure 2 the

flame effect element 58 is formed from a single sheet of a light-weight, substantially opaque, material such as polyester. The element 58 extends across substantially the full width of the screen 42. A plurality of slits are cut into the flame effect element 58 to permit passage of light through the flame effect element 58 as it billows under the influence of air currents from the blower 60. Alternatively, the flame effect element could comprise a plurality of discrete flame effect elements 58 as disclosed in US Patent 4,965,707 that is incorporated herein by reference.

[0013] The flame effect element 58 is supported at its bottom end by fasteners 70 that connect to the lower horizontal support member 50. The flame effect element 58 is supported at its upper end by fasteners 72 that connect to an upper horizontal support member 74. The upper horizontal support member is connected by fasteners 76 to the side walls of the housing 14.

[0014] The flame effect element 58 is supported relatively loosely between the horizontal supports so that it will billow or ripple with the air currents from the blower 60. The blower 60 is supported by a mounting bracket 78 that is supported with fasteners 80 to the bottom wall of the housing 14. An airflow control switch 83 is provided on the control unit 21 to vary the blower airflow to a desired amount. The greater the airflow, the more active the flame will appear. Alternatively, the flame-effect element 58 may be moved mechanically to produce sufficient billowing or rippling to give the flame effect.

[0015] In use, light is transmitted from the light source 30 through the slits of the flame effect element 58 to the diffusing surface 46 of the screen 42. The flame effect element 58 billows in the airflow from the blower 60 to vary the position and size of the slits. The resulting effect is for the transmitted light to resemble flames licking from a fire.

[0016] The upper and lower flicker elements 62, 64 are located rearwardly from the flame effect element 58 proximate to the rear wall of the housing 14. Each flicker element comprises an elongate rod 81 having a plurality of reflective strips 82 extending radially outwardly therefrom.

[0017] The rods 81 are supported at one end in corresponding recesses 84 defined in a vertical support arm 86 that is connected by fasteners to the bottom wall of the housing 14. The rods 81 are connected at their other end to corresponding rotors for rotating each rod 81 about its axis. The rotors are rotated by electric motors. Alternatively, the rotor 90 may be rotated by air currents from the blower 60 engaging corresponding fins on the rotors. Preferably, the rotors 90 rotate the flicker elements 62, 64 in the direction indicated by arrow 93 in Figure 2 so that an appearance of upward motion is imparted on the reflected light images. This simulates the appearance of upwardly moving gasses from the fire. It is contemplated that other means for simulating the appearance of upwardly moving gasses may be used. For instance, a light source (not shown) may be contained within a moving, partially opaque, screen (not shown) to produce the desired light effect It is also contemplated that the flicker elements 62, 64 or the above described gas simulating means may be used alone without the flame effect element 58. It has been found that the use of the flicker elements 62, 64 alone produces a realistic effect although not as realistic as when used in combination with the flame effect element 58.

[0018] Referring to Figure 3, a further improved vertical screen 42 is shown. The screen 42 is generally transparent and has a partially reflecting surface 44 and a diffusing region 46 through its thickness. The screen 42 is fabricated form a generally transparent but partially translucent material preferably having a slightly clouded or milky appearance through its thickness, such that light passing through the screen 42 is partially transmitted and partially diffused. A satisfactory material is a polystyrene which is given a slightly milky appearance by the addition of an amount of a powdered white pigment, such as titanium dioxide. The particle size of the pigment material is preferably microscopic so that a uniformly clouded or milky appearance is imparted to the diffusing region 46. The amount of diffusion achieved by diffusing region 46 can be controlled by the amount of pigment added to the plastic composition of diffusing region 46. The amount of diffusion achieved by diffusing member 46 should be such that a three-dimensional flame appears through the thickness of diffusing member 46, when viewed through partially reflecting member 44.

[0019] The embodiment shown in Figure 3 does not include a blower 60 or a light-weight flame effect element 58 adapted to billow in the airflow of blower 60. Instead, simpler flame effect element 58 is positioned behind and substantially across the full width of the screen 42 (a screen 42, as shown in Figure 2, may equally be used), and in front of back wall 300. The improved flame effect element 58 has a reflective surface 302 and generally has a flame-like profile. Back wall 300 has a nonreflective surface. In a preferred embodiment, the element 58 is a reflective decal applied to the surface of back wall 300.

[0020] A single flicker element 62, rotating in direction 93, is positioned below the fuel bed 26 and generally in front of flame effect element 58. Adjacent and behind the flicker element 62 is positioned the light source 30. A light block 310 is provided to prevent light from light source 30 from reaching the flame effect element 58 directly. Hence, substantially only light reflected from flicker element 62 reaches flame effect element 58 and is subsequently reflected to, and transmitted through, screen 42.

[0021] The embodiment depicted in Figure 3 may further include a transparent light randomizing panel 312, positioned between fuel bed 26 and flicker element 62. The panel 312 is preferably made of glass or optical grade plastic and has non-planar surfaces 314 and 316. The surfaces 314, 316 each have convex and concave regions which smoothly and contiguously blend into one

another, resulting in a panel 312 having a varied thickness. In use, panel 312 acts as a complex lens, with regions of varied focal length, to light reflecting towards fuel bed 26 from flicker element 62, which is rotating in direction 93. The effect of the complex lens-like characteristics of panel 312 is to intermittently reverse the direction of the reflected light from flicker element 62 as it crosses fuel bed 26. The result is that the simulated coals of fuel bed 26 appear to flicker in a random direction, and not only in the direction of rotation of flicker element 62.

[0022] Referring especially to Figs. 1, 3 and 4, a fireplace assembly 10 with a simulated brick or rock fire wall 400 is depicted. Referring to Fig. 3, simulated fire wall patterns 402, 404 are applied to the inner surfaces of transparent front panel 24 and each of side walls 23, respectively. Fire wall pattern 404 is applied by painting, or similar method, the pattern 404 on the inner surface of each side wall 23. The pattern 402, as will be explained further below, is applied to the inner surface of transparent front panel 24 preferably by applying, using a silk-screening method, a series of small colored dots in a random pattern. The dots are applied in such a manner that an observer positioned in front of transparent front panel 24 will not readily notice the dots applied to the inner surface of the panel 24 but will, however, notice the reflection of the dots in the reflecting surface 44. The effect gives the illusion of a fire wall appearing behind the image of the simulated flames emanating from the fuel bed 26. Light source 57 is provided beneath top wall 16 to light the pattern 402 to strengthen its reflection in surface 44. To create a more realistic lighting of patterns 402,404, light source 57 may be made to flicker randomly to simulate lighting on the simulated fire wall 400 by a real flame. The flicker in light source 57 could be achieved by integrated circuit control (not shown) of the elechicity supplied to light source 57.

[0023] Referring to Fig. 4, a preferred method of applying pattern 402 to the interior surface of front panel 24 is shown. First, a random pattern of small dots 406 is applied to the inner surface of front panel 24. Although random, the pattern of dots 406 has a constant dot density per square inch across the entire inner surface of front panel 24. Dots 406 are preferably all the same size. The dot density and a size of dots 406 are preferably chosen such that the presence of the dots 406 is not readily noticeable to an observer and the only effect imparted to the glass by the presence of dots 406 is a smoked or tinted appearance to transparent front panel 24. This effect is best achieved if the dots 406 are black in color. Preferably the dots 406 are applied to the inner surface of panel 24 using a silk screening process. Once the dots 406 have been applied, a set of colored dots 408, of slightly smaller diameter than dots 406, is applied on top of dots 406. Dots 408 are of slightly smaller diameter than, and located concentrically on, dots 406 to ensure that an observer positioned in front of assembly 10 will not notice the presence of dots 408 on the inner surface of transparent panel 24. The dots 408 are also preferably applied using a silk screening process. Dots 408 preferably appear in two colors, the two colors being the color of the simulated brick and the color of the simulated mortar between the simulated bricks. The color of a particular dot 408 is preferably chosen such that an overall brick and mortar pattern is formed on the inner surface of front panel 24.

[0024] In use, the presence of the dots 406 and 408 on the inner surface of transparent front panel 24 is not readily noticed by an observer positioned in front of flame simulating assembly 10, however, the reflection of the colored dots 406 in reflecting surface 44 is readily apparent to the observer. The simulated fire wall 400 appears to the observer to be behind fuel bed 26 at twice the distance of front panel 24 to the back of fuel bed 26. By locating dots 406 randomly across the inner surface of front panel 24, a visible interference pattern is avoided. This interference pattern would appear if the dots were regularly located on the inner surface of front panel 24, the interference pattern being caused between the presence of dots 406, 408 on the inner surface of panel 24 and the reflection of dots 406, 408 on reflecting surface 44. Dots 406 are applied with a constant dot density per square inch to ensure that the smoked or tinted appearance which dots 406 impart to front panel 24 is constant across front panel 24. The colors chosen for pattern 402 are also the colors used for pattern 404 on side walls 23. The patterns 402 and 404 are positioned on the inner surface of front panel 24 and side walls 23, respectively, such that the apparent brick and mortar features of the two patterns intersect and mate in a realistic fashion.

[0025] It will be apparent that the simulated fire wall pattern 402 can also be achieved using alternative means. For example, a CLEAR FOCUS™ one-way vision display panel (not shown), as is described in U.S. Patent No. 5, 525,177, may be used. Simulated fire wall pattern 402 can be applied to the display surface of a CLEAR FOCUS™ panel which is, in turn, applied to the inner surface of front panel 24, such that an observer positioned in front of flame simulating assembly 10 cannot see pattern 402 directly but can view the reflection of pattern 402 in reflecting surface 44. In another embodiment, the transparent front panel 24 is replaced by a mesh front fire screen 24 (not shown), and the simulated fire wall pattern 402 is applied, with paint or similar means, to the inner surface of fire screen 24. If care is used to ensure that the pattern 402 is applied only to the interior surface of fire screen 24, the pattern 402 will not be directly visible to an observer standing in front of flame simulating assembly 10. The observer will, however, be able to view the reflection of pattern 402 on reflecting surface 44.

[0026] It is readily apparent that the apparatus to produce simulated fire wall 400 could be used successfully with any fireplace having a front panel 24 and reflecting surface 44. In particular, it will be apparent that the in-

clusion of a simulated fire wall 400 would greatly enhance the appearance of a natural gas or propane fireplace. By using the disclosed apparatus to create a simulated fire wall 400, the depth of a fireplace may be decreased as a space-saving measure, however, an observer will not notice that the depth of the fireplace has been decreased.

Claims

1. A fireplace assembly comprising:

   a substantially transparent front wall (24) having a rear surface and a front surface;
   a reflective surface (44) spaced from and facing said rear surface of said front wall (24); and **characterised in that**
   an image is applied to said rear surface of said front wall, said image being substantially invisible to a observer looking through said front surface other than as a reflected image in said reflective surface.

2. An assembly as claimed in claim 1, further comprising a light source (57) for illuminating the image applied to said rear surface of said front wall.

3. An assembly as claimed in claims 1 or 2, further comprising two opposing side walls (23) each having an image being applied to their opposing surfaces.

4. An assembly as claimed in claim 3, wherein said image applied to said side walls substantially matches said image applied to said rear surface of said front wall as reflected in said reflective surface (44).

5. An assembly as claimed in any one of the preceding claims, wherein said image if defined by a plurality of dots (406).

6. An assembly as claimed in claim 5, wherein said dots are randomly disposed on said rear surface to avoid an interference pattern being formed.

7. An assembly as claimed in claims 5 or 6, wherein said dots have a sufficiently constant density over said rear surface to produce a substantially constant tinted appearance to said front wall when observed through said front surface.

8. An assembly according to any of claims 5 to 7, wherein said dots are substantially uniform in size.

9. An assembly according to any one of claims 5 to 8, wherein said dots are round.

10. An assembly according to any of claims 5 to 9, wherein said dots comprise first dots applied to said rear surface and second dots applied to said first dots (406), said second dots (408) being smaller than said first dots.

11. An assembly according to any of the preceding claims wherein said image is defined by a one-way vision display panel.

12. An assembly according to any of the preceding claims, wherein said front wall is a mesh fire screen.

Patentansprüche

1. Feuerstellenanordnung mit:

   einer im Wesentlichen transparenten Vorderwand (24) mit einer hinteren Oberfläche und einer vorderen Oberfläche,

   einer reflektierenden Oberfläche (44), die auf Abstand zu der hinteren Oberfläche der Vorderwand (24) und diese zugewandt angeordnet ist, und **dadurch gekennzeichnet, dass**

   ein Bild auf der hinteren Oberfläche der Vorderwand aufgebracht ist, wobei das Bild für einen Beobachter, der durch die vordere Oberfläche blickt, im Wesentlichen unsichtbar ist, außer als an der reflektierenden Oberfläche reflektiertes Bild.

2. Anordnung nach Anspruch 1, die weiter eine Lichtquelle (57) zum Illuminieren des an der hinteren Oberfläche der Vorderwand angebrachten Bildes aufweist.

3. Anordnung nach Anspruch 1 oder 2, die weiter zwei gegenüberliegende Seitenwände (23) aufweist, die jeweils ein auf ihren gegenüberliegenden Oberflächen angebrachtes Bild aufweisen.

4. Anordnung nach Anspruch 3, wobei das auf die Seitenwände aufgebrachte Bild im Wesentlichen zu dem an der hinteren Oberfläche der Vorderwand angebrachten Bild, wie es an der reflektierenden Oberfläche (44) reflektiert wird, passt.

5. Anordnung nach einem der vorhergehenden Ansprüche, wobei das Bild durch eine Vielzahl von Punkten (406) definiert ist.

6. Anordnung nach Anspruch 5, wobei die Punkte zufällig an der hinteren Oberfläche angeordnet sind, um die Bildung eines Interferenzmusters zu verhindern.

7. Anordnung nach Anspruch 5 oder 6, wobei die Punkte einer über die hintere Oberfläche hinreichend konstante Dichte haben, um der Vorderwand eine ausreichend konstant getönte Erscheinung zu geben, wenn sie durch die vordere Oberfläche beobachtet wird.

8. Anordnung nach einem der Ansprüche 5 bis 7, wobei die Punkte im Wesentlichen von gleichmäßiger Größe sind.

9. Anordnung nach einem der Ansprüche 5 bis 8, wobei die Punkte rund sind.

10. Anordnung nach einem der Ansprüche 5 bis 9, wobei die Punkte erste Punkte umfassen, die auf die hintere Oberfläche aufgebracht sind, und zweite Punkte umfassen, die auf die ersten Punkte (406) aufgebracht sind, wobei die zweiten Punkte (408) kleiner als die ersten Punkte sind.

11. Anordnung nach einem der vorhergehenden Ansprüche, wobei das Bild durch eine Einweganzeigefläche definiert wird.

12. Anordnung nach einem der vorhergehenden Ansprüche, wobei die Vorderwand ein Maschenfeuerschirm ist.

Revendications

1. Ensemble de foyer comprenant :

   une paroi avant essentiellement transparente (24) comportant une surface arrière et une surface avant ;

   une surface réfléchissante (44) espacée de, et faisant face à, ladite surface arrière de ladite paroi avant (24); et **caractérisé en ce que**

   une image est appliquée à ladite surface arrière de ladite paroi avant, ladite image étant essentiellement invisible à un observateur regardant à travers ladite surface avant autrement que comme une image réfléchie par ladite surface réfléchissante.

2. Ensemble selon la revendication 1, comprenant en outre une source de lumière (57) pour illuminer l'image appliquée à ladite surface arrière de ladite paroi avant.

3. Ensemble selon la revendication 1 ou 2, comprenant en outre deux parois latérales (23) opposées, chacune ayant une image qui est appliquée à leurs surfaces opposées.

4. Ensemble selon la revendication 3, dans lequel ladite image appliquée auxdites parois latérales s'ajuste essentiellement avec ladite image appliquée à ladite surface arrière de ladite paroi avant telle que réfléchie par ladite surface réfléchissante (44).

5. Ensemble selon l'une quelconque des revendications précédentes, dans lequel ladite image est définie par une pluralité de points (406).

6. Ensemble selon la revendication 5, dans lequel lesdits points sont disposés au hasard sur ladite surface arrière pour éviter qu'un motif d'interférence ne soit formé.

7. Ensemble selon la revendication 5 ou 6, dans lequel lesdits points ont une densité suffisamment constante sur ladite surface arrière pour produire un aspect teinté essentiellement constant sur ladite paroi avant lorsqu'il est observé à travers ladite surface avant.

8. Ensemble selon l'une quelconque des revendications 5 à 7, dans lequel lesdits points sont essentiellement uniformes en taille.

9. Ensemble selon l'une quelconque des revendications 5 à 8, dans lequel lesdits points sont ronds.

10. Ensemble selon l'une quelconque des revendications 5 à 9, dans lequel lesdits points comprennent des premiers points appliqués sur ladite surface arrière et des seconds points appliqués sur lesdits premiers points (406), lesdits seconds points (408) étant plus petits que lesdits premiers points.

11. Ensemble selon l'une quelconque des revendications précédentes, dans lequel ladite image est définie par un panneau d'affichage à vision unidirectionnelle.

12. Ensemble selon l'une quelconque des revendications précédentes, dans lequel ladite paroi avant est un pare-feu à mailles.

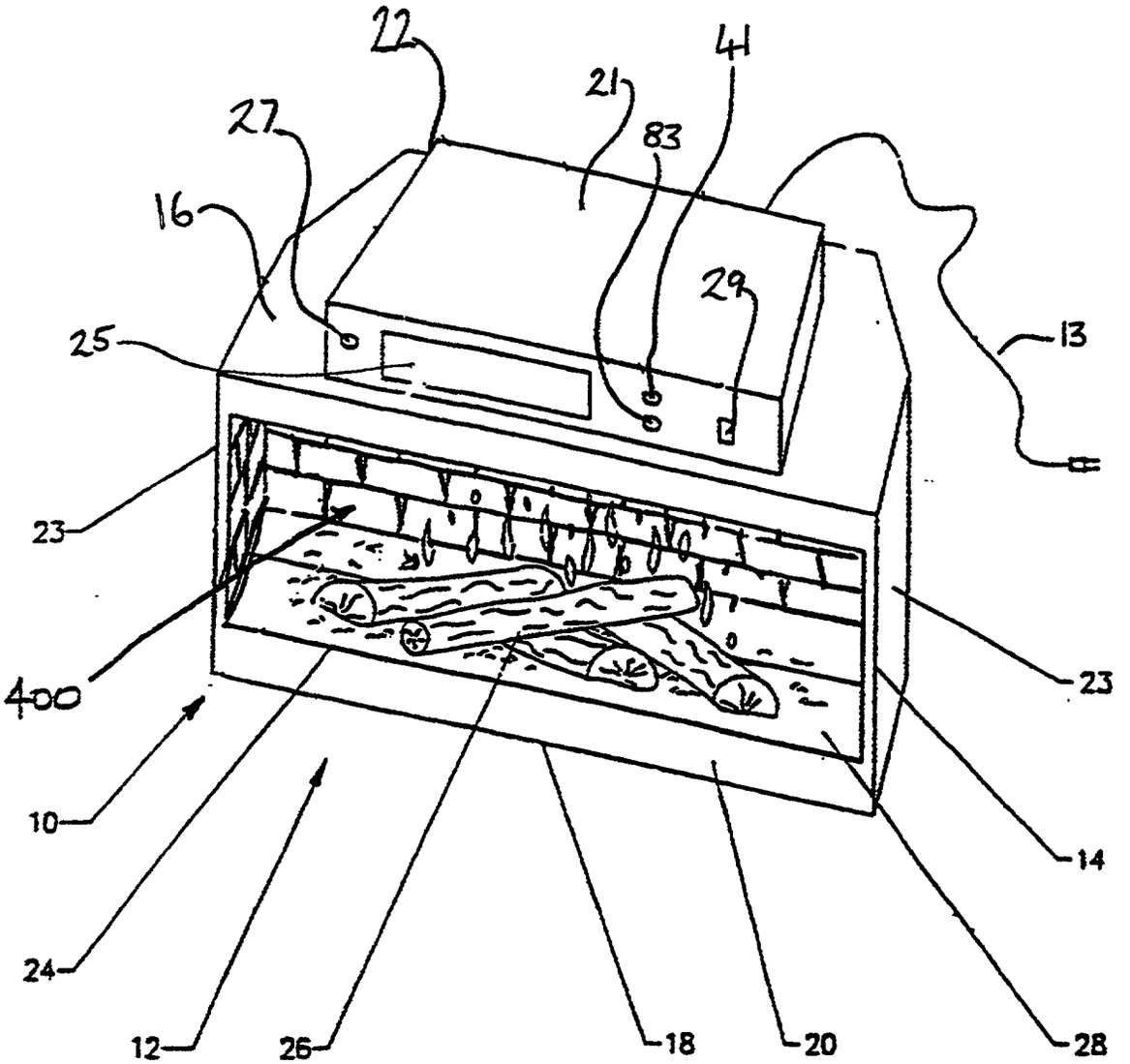

FIG. 1

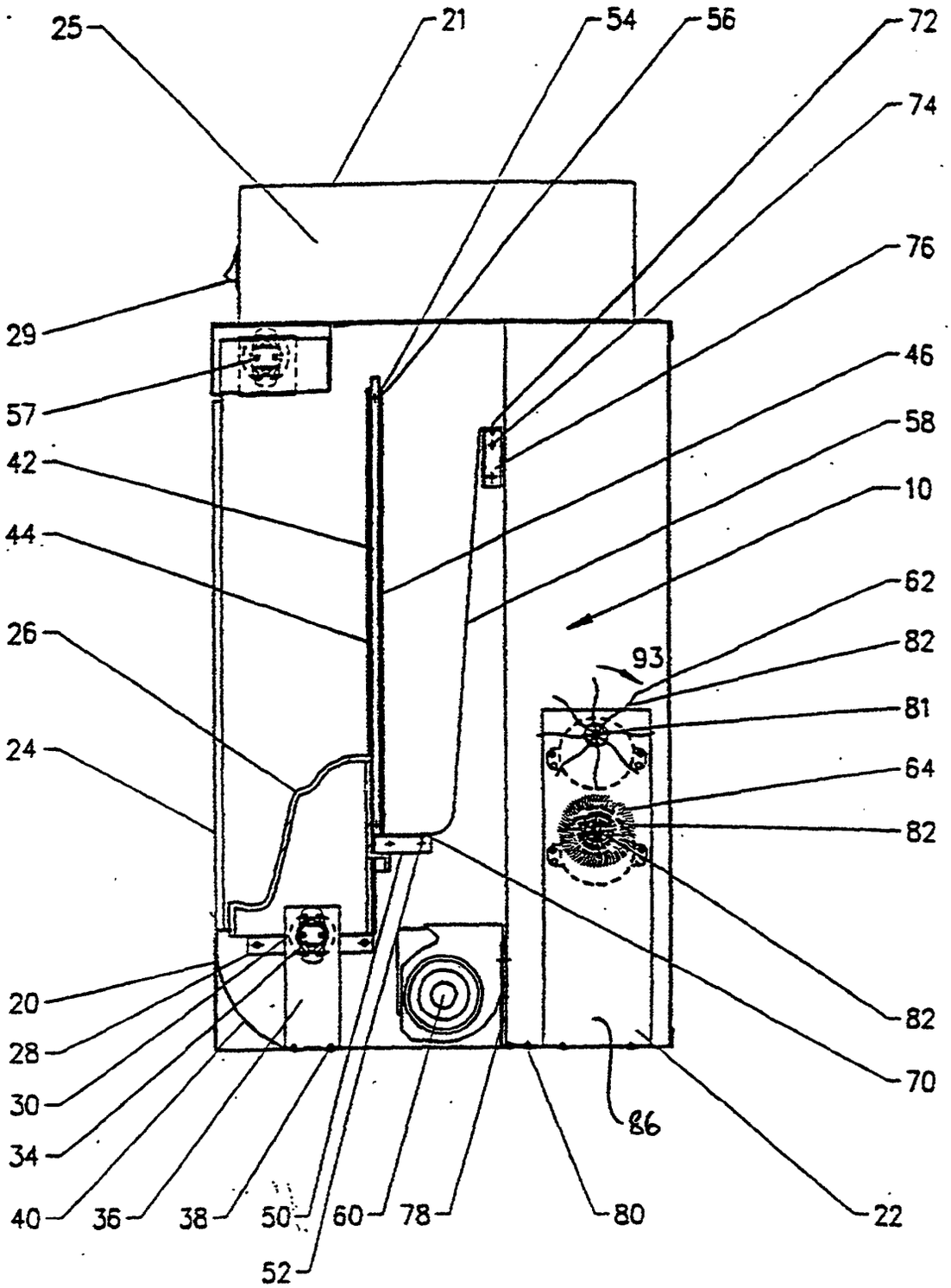
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FIG. 2

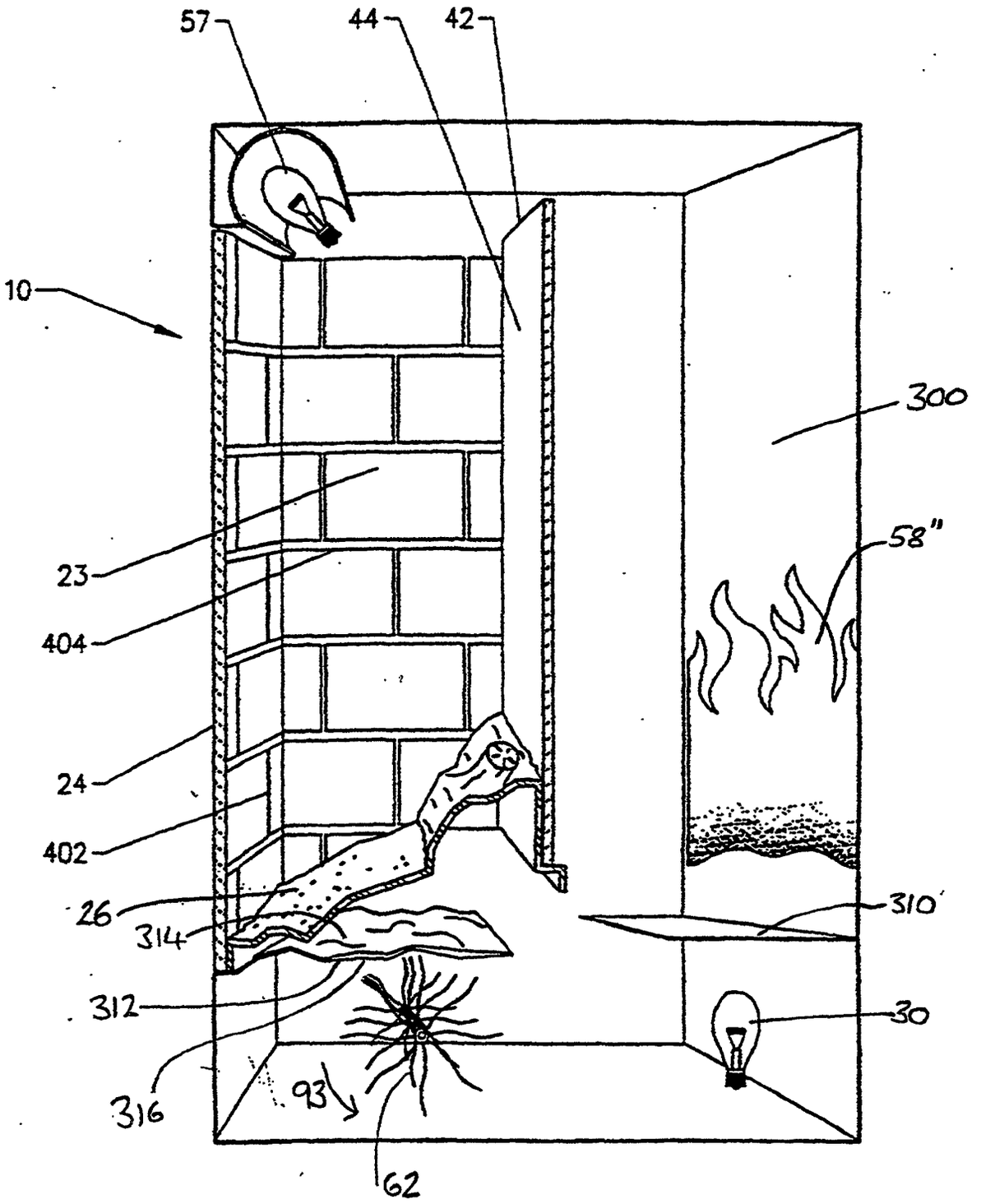

Fig 3

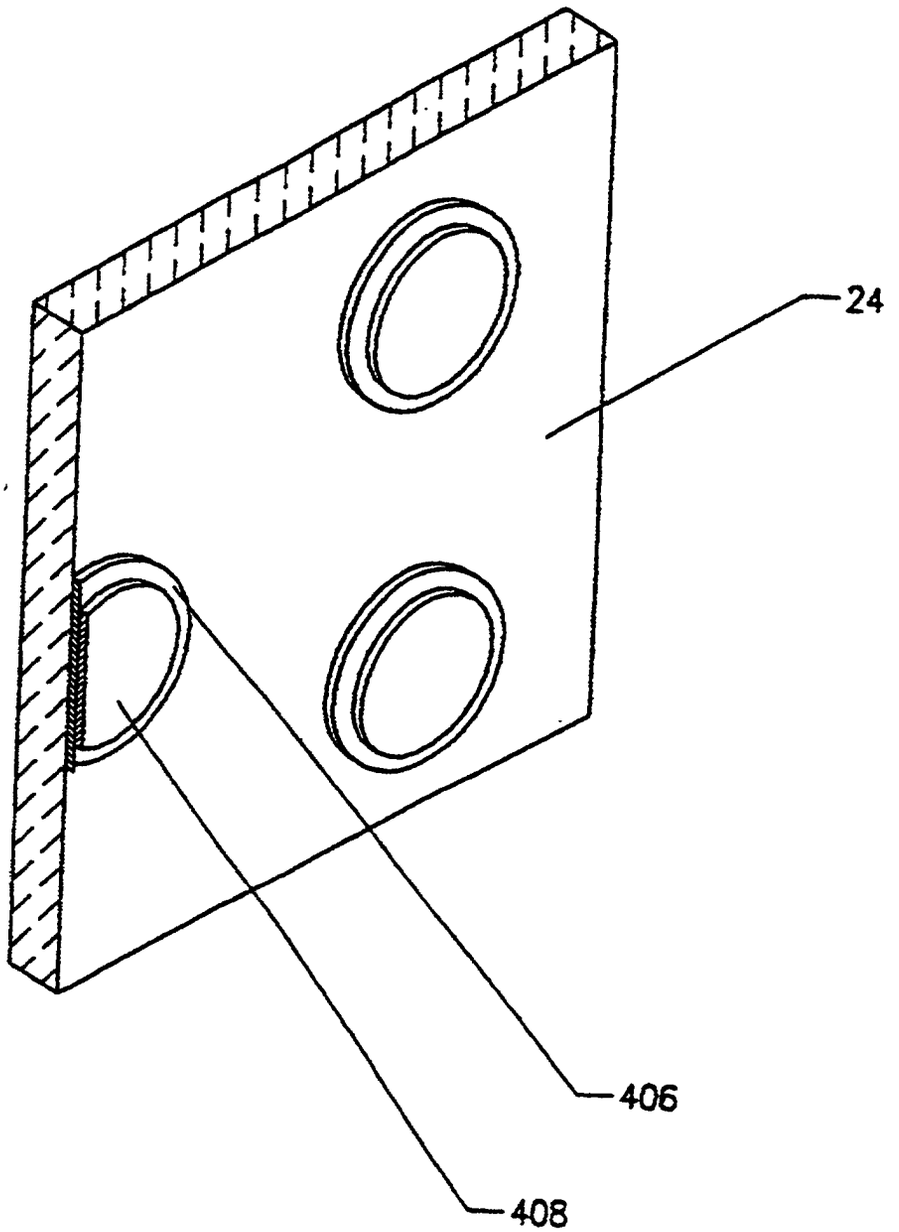

Fig 4