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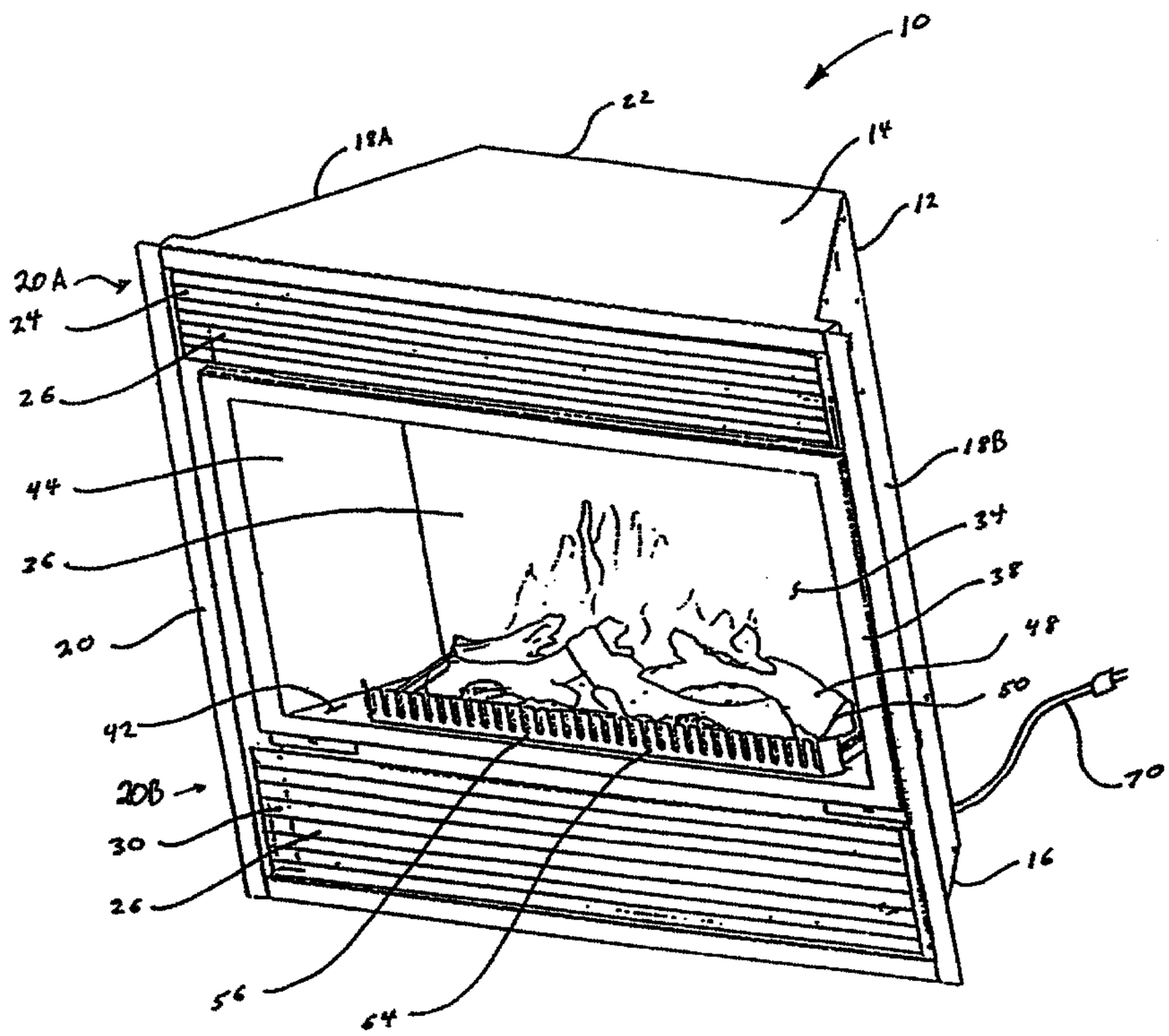
(71) Demandeur/Applicant:
CFM MAJESTIC INC., CA

(72) Inventeurs/Inventors:
JAMIESON, DONALD R., CA;
DUNG, DIEP CHI (DAVID), CA;
LUU, DUONG (ANDY), CA

(74) Agent: SIM & MCBURNEY

(54) Titre : FOYER A FLAMME SIMULEE
(54) Title: FIREPLACE WITH SIMULATED FLAME



(57) Abrégé/Abstract:
A fireplace assembly is provided by which the image of a working combustible fuel-burning fireplace may be simulated. The fireplace assembly includes a housing having a lenticular panel assembly including a moving simulation of at feast flames for generating the appearance of simulated flames within the housing. The lenticular panel assembly includes a means for mounting and rotating the panel through an arc to provide the illusion of moving flames within the fireplace assembly.

ABSTRACT

A fireplace assembly is provided by which the image of a working combustible fuel-burning fireplace may be simulated. The fireplace assembly includes a housing having a lenticular panel assembly including a moving simulation of at least flames for generating the appearance of simulated flames within the housing. The lenticular panel assembly includes a means for mounting and rotating the panel through an arc to provide the illusion of moving flames within the fireplace assembly.

FIREPLACE WITH SIMULATED FLAME

FIELD OF THE INVENTION

This invention relates to fireplaces. More particularly, the present invention relates to a fireplace assembly that simulates the flames emanating from a bed of logs and glowing embers of an actual wood-burning fireplace using a moving image applied to a lenticular panel.

BACKGROUND OF THE INVENTION

Fireplaces are desirable features in the home. However, for many years, in response of an increased population density in certain areas and an increased sensitivity to environmental concerns, wood-burning fireplaces have been discouraged, banned and replaced by gas, electric or otherwise simulated fireplaces.

Fireplaces of various designs have been suggested that provide a simulated fire and related effects with varying degrees of success. Gas fireplaces successfully provide real flames and heat. Typically, simulated logs and embers are provided to give the impression of a wood fire. However, the expense of the gas can be high and a working flue is usually required to vent the combustion products. Electric fireplaces may be installed in locations where gas fireplaces are not desired or will not fit. An electric fireplace may provide a reasonably realistic simulation of a wood-burning fireplace. The success of the simulation depends on the skill of the manufacturer to provide various mechanisms to manipulate various combinations of lights, screens, and filters, and so on, to provide a random and lifelike flame and ember effect. While generally less expensive than a wood burning or gas fireplace, the complexity of the unit and skill necessary to produce a realistic simulation can be quite high.

There is a demand therefore for a simple and cost-effective simulated fireplace that accurately and realistically simulates a combustible fuel-burning fireplace. The present invention satisfies the demand.

SUMMARY OF THE INVENTION

The present invention has a principal objective of providing a realistic simulation of a combustible fuel-burning fireplace or like device.

One embodiment of the present application provides a fireplace having a firebox housing with a top, a bottom, a back and two sides. The firebox housing includes a lenticular panel assembly for generating the appearance of simulated flames emanating from artificial logs in the fireplace firebox. The lenticular panel assembly includes a lenticular panel having a plurality of incorporated interleaved images of a fire as from a movie or the like. A motor and associated mechanism may be operatively attached to the lenticular panel adapted to rock the lenticular panel through a predetermined arc in such a manner as to animate, display or replay the images from the movie to a viewer. The lenticular panel may be backlit or otherwise illuminated by one or more lights to enhance the viewability of the images.

In another embodiment of the present invention, the housing may further include a log and ember set having one or more artificial logs positioned above an artificial bed of embers. The fireplace may also include a means for illuminating the underside of at least a portion of the artificial logs and a portion of the artificial bed of embers so as to create the illusion that the artificial logs and the artificial bed of embers are glowing. In particular, a light can be projected upwardly through openings in the artificial bed of embers and onto the underside and sides of the artificial logs. Some of the light striking the underside of the artificial logs may be redirected back down on to the bed of embers.

According to one aspect of the invention, there is provided a fireplace assembly comprising:

a housing;

a lenticular panel assembly positioned within said housing, said lenticular panel assembly including a lenticular panel and a mount attached thereto, said mount adapted to permit said lenticular panel to pivot about said mount; and

means for providing reciprocating motion to said lenticular panel through a predetermined range of motion.

These and other advantages, as well as the invention itself, will become apparent in the details of construction and operation as more fully described and claimed below. Moreover, it should be appreciated that several aspects of the invention can be used in other applications where accurate flame simulations would be desirable.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an embodiment of a fireplace including the simulated flame assembly according to the present invention;

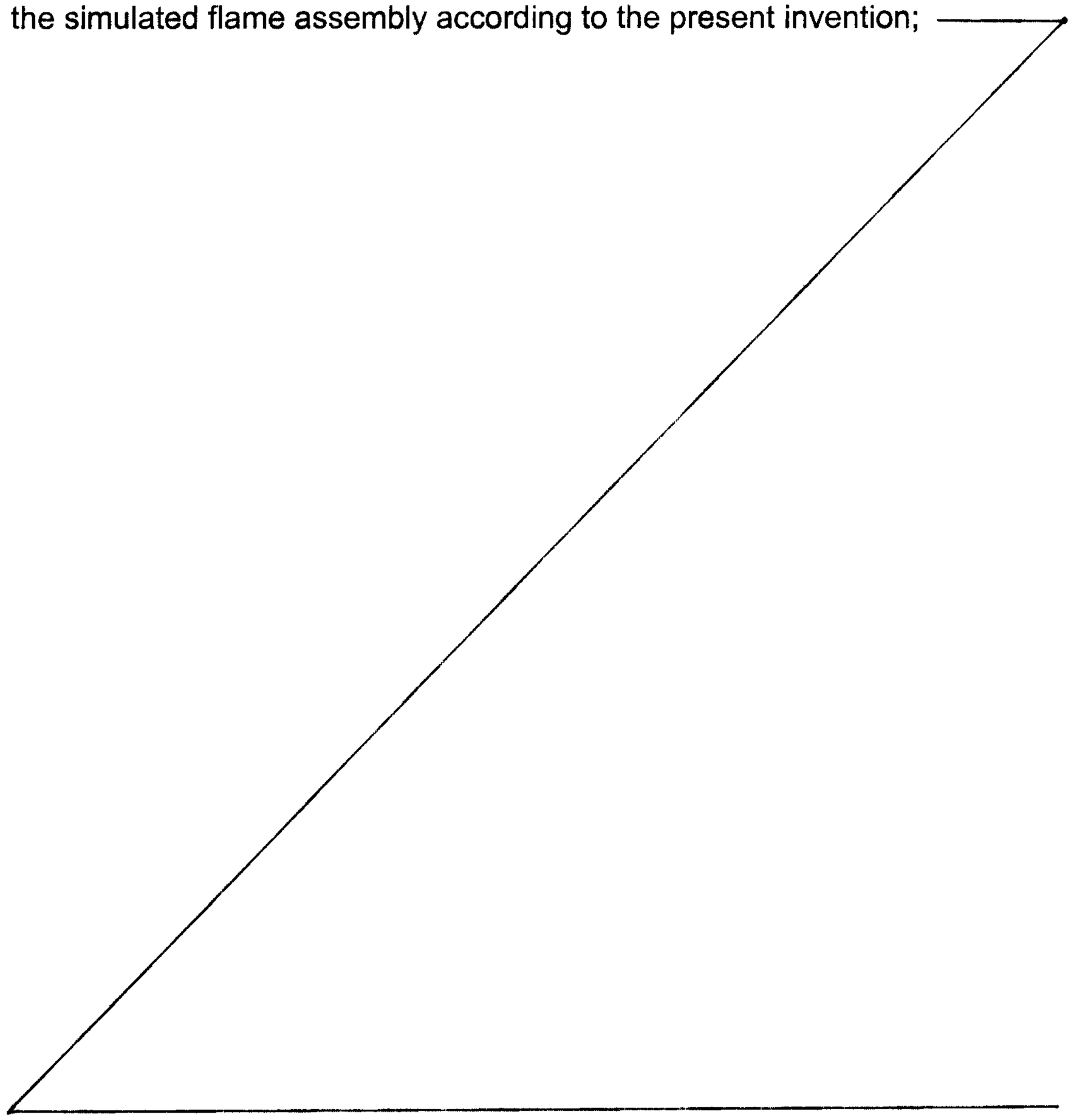


FIG. 2 is a side view of an embodiment of a fireplace including the simulated flame assembly according to the present invention;

FIG. 3 is a top view of the embodiment of FIG. 1;

FIG. 4 is a front view of the embodiment of FIG. 1; and

FIG. 5 is an exploded view of one embodiment of an ember and log set of the present invention.

DETAILED DESCRIPTION OF PRESENTLY PREFERRED EMBODIMENTS

A fireplace assembly 10 according to the present invention is illustrated in FIGS. 1-5 and includes a housing 12 having a housing top 14, a housing bottom 16, left and right housing sides 18A, 18B, a housing front 20 and a housing back 22. The housing 12 may be manufactured from any suitable material, such as, for example sheet metal. In such a case, the sheet metal can be cut, bent and formed by joining and the like, to form the structure of the housing 12. In the embodiment shown, the housing back 22 and housing sides 18A, 18B may be cut from a single piece of sheet metal and bent into shape.

For purposes of this application, the combined housing back 22 and housing sides 18A, 18B of the housing 12 is commonly referred to as the fireplace wrapper. In the alternate, the housing top 14 and housing bottom 16 panels can be attached to the housing back 22 and housing sides 18A, 18B to complete the basic structure of the housing 12 by known methods. In such a case, the edges of the individual sheet panels (14, 16, 18A, 18B, 20 and 22) are typically bent to provide a small overlap at the juncture of adjoining panels. The metal panels may then be joined together by any suitable fastening method, such as, for example, fasteners, sheet metal screws, or by crimping or welding.

A lenticular panel assembly 100, in the embodiments of the fireplace assembly 10 illustrated in FIGS. 2 and 3, is provided by a lenticular panel 84, a panel frame 86 arranged about the lenticular panel 84 for supporting the panel, a panel mount 88 for permitting rotation of the lenticular panel, and an electric motor 90 for imparting periodic motion to the panel 84. Lenticular refers to a combination of several combined digitally interlaced printed or photographic images with a

specially designed ribbed plastic lenticular lens. Viewing the interlaced image through the lens (when either the viewer or panel moves) causes the eyes to "see" depth, motion, or other effects in what is actually a flat, static combined image. The sequential presentation of the images through the lens simulates motion. For this reason, it is preferred that the lenticular panel 84 is caused to be oscillated periodically, either back and forth altering a vertical plane of the panel, or from side to side to provide an image of moving flames and associated effects to a viewer. For purposes of this application, reciprocating motion refers to the motion of the panel 84, which is a periodic arcuate rotation of the panel about a point. The motion causes a first portion of the panel located on one side of the pivot to move in a first direction while a second portion of the panel located on the other side of the pivot moves in a direction opposite the first.

The lenticular panel assembly 100 for simulating at least a moving flame is positioned adjacent an inside surface 22A of the housing back 22. The lenticular panel assembly 100 may be used alone to create an appearance of realistic flames in a fireplace or in another embodiment of the present invention may be used to create the appearance of realistic looking flames in combination with an artificial log and ember set 48, which will be explained more fully below.

The lenticular panel assembly 100 may include associated therewith a first light source 82 for illuminating the lenticular panel 84, a drive cam 92 for urging the panel into an oscillating motion and a return member 94. A spring may be a suitable return member 94. The return member 94 is provided to bias the lenticular panel 84 against the drive cam 92.

The lenticular panel 84 can be held by frame 86 in position adjacent the housing back 22 by a pair of pivoting mounts 88, which are connected to the housing sides 18A, 18B. The mounts 88 may be located at a position between the top end 87 and a bottom end 85 of lenticular panel 84. The electric motor 90 and the drive cam 92 can be located at a position at or near top end 87. In the alternate, the motor 90 may be positioned anywhere from adjacent the top end 87 to the bottom end 85 of the panel 84. The electrical motor 90 can be a conventional A/C or D/C

gear motor. In the alternate, a variable-speed motor may be employed. The lobes (not shown) of the cam drive 92 are adapted to contact the panel frame 86 and provide the desired reciprocation, periodic rocking motion or angular deflection of the lenticular panel 84. It will be understood that the drive cam 92 may have a configuration or profile like that of a cam, i.e., a disc, shaped to convert circular motion into linear motion when rotated. The drive cam 92 can include one or a plurality of lobes, e.g., six cam lobes on one drive wheel. The return member 94 can attach between the lenticular panel 84 at a top end 87 and the housing back 22.

It will be understood that a number of devices and methods may be used to impart periodic motion to the panel 84. For example, the drive cam 92 may be replaced with a linkage arm or the like (not shown). In this manner, the spring 94 may be eliminated as the arm would both urge the panel 84 away and toward an initial starting point of the periodic motion.

During operation of the motor 90, lobes of the drive cam 92 engage the panel frame 86 or lenticular panel 84 and cause the lenticular panel to rock slowly or reciprocate about the mount 88 in a predetermined arc. The reciprocating time or period is dependent upon the panel design and specifications. In one embodiment of the invention, the period of reciprocating motion is from about 1/2 second to about 12 seconds. Preferably, the period is longer, such as from about 6 to 9 seconds. The amount of arc also relates to the specific characteristics of the panel. For the purposes of the present invention, the amount of arc or predetermined amount of arc refers to the distance the panel is required to travel so that a person may view an effective amount of the moving image to produce an effective simulation of, for example, a wood-burning fire. This amount may be from about 5 degrees to about 45 degrees or more. In one embodiment of the invention, the panel rotates or swings through an arc of about 20 degrees. It will be understood that other suitable methods may be used to rock the panel. In this manner, a viewer is provided with the simulated flame motion embedded in the lenticular panel 84. The return member 94 provides a bias force to the panel 84 to both ensure a smooth contact of the

panel 84 to the drive cam 92 and a return to a starting point of the oscillating or cyclical periodic motion of the panel.

The electric motor 90 is connected to a source of electric power 70 and to an on/off rocker switch (not shown) of control unit 32 located on the housing front 20 behind the lower louver panel 30. The electrical wiring (not shown) necessary to connect these components together is well known in the art. In the preferred embodiment shown, the electric motor 90 can be turned on and off by the same control unit 32 that is used to turn on and off the incandescent light bulbs 66 and 82 of the fireplace assembly 10. In the alternate, for example, fluorescent or halogen bulbs could be used in place of the bulbs 66. The rotational speed of the motor 90 and cam 92 can also be controlled or adjusted through use of control unit 32.

The lenticular panel assembly 100 is compact, thereby reducing the overall depth of the fireplace assembly 10. This allows the fireplace assembly 10 to be installed in locations that may not otherwise permit installation of a combustible fuel-burning fireplace or an electric fireplace of a different design. In the preferred embodiment shown, the depth of the lenticular panel and frame assembly 100 (i.e., the distance between the panel 84 and the housing back 22) can be less than about 4 inches, and the overall depth of the electric fireplace can be made to be approximately 11-12 inches.

In one embodiment of the invention, the lenticular panel 84 is backlit by first light source 82, which may be located on or adjacent the housing back 22 and housing bottom 16. The light source 82 may include one or more incandescent bulbs 66 or an equivalent could be used. In the alternate, for example, fluorescent or halogen bulbs could be used. The light source 82 is located beneath the bottom panel 42 of the firebox 36 to provide backlighting to the lenticular panel 84. Alternatively, light source 62 that provides light for the illumination of the artificial log and ember set 48 can be used to light the lenticular panel 84. Bracket 88 attached to the housing bottom 16 may be used to support the light source 82. The light bulbs 66 are connected to an electric power source 70 and to control unit 32 located near the front 20 of the housing 12 behind the lower louver panel 30 (see FIG. 2). A

dimmer control (not shown) can also be provided the control unit 32 to permit a viewer to adjust the degree of illumination. The electrical wiring (not shown) necessary to connect these components together is well known in the art.

In another embodiment of the present invention the upper housing front 20A of the front 20 of the fireplace assembly 10 can preferably include an upper louver panel 24 having a series of spaced generally horizontal upper slats 26. The upper slats 26 are spaced apart to permit air from an adjoining room (not shown) to pass in through the upper louver panel 24 and subsequently may be expelled or circulated back into the room. The upper slats 26 of the upper louver panel 24 may be angled upwardly from front to back in such a manner as to prevent viewing of a heater assembly 28 positioned behind the upper louver panel 24 from the front of the assembly 12. The upper louver panel 24 can be made to be removable to permit access to the heater assembly 28 in the event that maintenance or repair becomes necessary.

The lower portion 20B of the housing front 20 of the fireplace assembly 10 includes a lower louver panel 30 of similar design and configuration as that of the upper louver panel 24. Thus, the lower louver panel 30 can include a series of horizontal slats 26 that are spaced and angled in a similar fashion as the upper slats 26 of the upper louver panel 24. A control unit 32, which may include one or more controls (not shown), such as, for example, switches, potentiometers and the like, for controlling various aspects of the operation of the fireplace assembly 10 (see FIG. 2) may be positioned behind the lower louver panel 30.

The lower louver panel 30 may be connected to the housing bottom 16 of the housing 12 with one or more hinges (not shown) or the like. The lower louver panel 30 may then be folded outwardly and downwardly to gain access to the control unit 32. The hinges may contain springs, or the like, that bias the lower louver panel 30 in the vertical or closed position.

The upper and lower louver panels 24, 30 may also be designed and configured to simulate a concealed heat exchanger plenum arrangement (not shown) of the type often incorporated in combustible fuel-burning fireplaces. For

example, natural gas fireplaces often have a series of interconnected plenums surrounding a firebox that form a convection air passage around the firebox. Room air is typically drawn into and expelled out from the plenum arrangement by passing through louver panels above and below the firebox. The upper and lower louver panels 24, 30 of one embodiment of the present invention are designed and configured to suggest the presence of a heat exchange plenum arrangement, thereby increasing the realism of the fireplace assembly.

In one embodiment of the present invention, the fireplace assembly 10 includes a firebox 36 positioned within the housing 12. The firebox may include a heater assembly 28 positioned above a top panel 40 of the firebox 36. The heater assembly 28 may include a heating element and tangential blower fan (not shown). As best seen in FIG. 2, the heated air from the heater assembly 28 is directed out through the front of the fireplace through the upper louver panel 24. The heater assembly 28 can draw the air to be heated from the room in which the fireplace 10 is situated. The heater assembly 28 is connected to a source of electric power 70 and can be controlled by control unit 32 on the front 22 of the fireplace 10 located behind the lower louver panel 30. The heater assembly may 28 also be connected to the control unit 32 including various controls including a thermostatically controlled switch (not shown) which automatically turns the heater assembly 28 on or off at pre-determined temperature settings.

As best seen in FIG. 2, the firebox 36 is positioned within the housing 12 of the fireplace 10 and comprises a top panel 40, a bottom panel 42, and two side panels 44. In the preferred embodiment shown, the firebox 36 extends from approximately the lower louver panel 30 to the upper louver panel 24. The top and bottom panels 40, 42 can be attached or fastened to the interior surface of the housing back 22 and two housing sides 18A, 18B of the housing 12. As will be discussed in greater detail below, the top and bottom panels 40, 42 of the firebox 36 may support various components of the fireplace assembly 10.

In one embodiment of the present invention, as best seen in FIG. 1, the fireplace housing sides 18A, 18B may define the side panels 44 of the firebox 36.

The firebox side panels 44 may be painted to appear like firebrick, which is typically used to line the firebox of combustible fuel-burning fireplaces. Alternatively, ceramic fiber refractory panels (not shown) that have been shaped and colored to look like firebrick can be attached to the interior surface of the housing to form a realistic-appearing firebox. The manufacturing process for vacuum forming and coloring ceramic fiber refractory panels is well known in the art. Other suitable materials can also be used to manufacture the artificial refractory panels.

The housing front 20 of the fireplace assembly 10 also may include a transparent viewing panel 34. The viewing panel 34 is positioned between the upper and lower louver panels 24, 30 and permits viewing of the firebox 36. The viewing panel 34 is supported by a doorframe 38 and may include hardware (not shown) designed to simulate a glass door assembly of the type typically used to enclose the firebox of a combustible fuel-burning fireplace. The viewing panel 34 may be either clear or tinted depending on the desired aesthetic appearance of the fireplace. Tinting of the viewing panel 34 may increase the realism of the fireplace by inhibiting the viewer's ability to discern the artificial components that have been used to create the illusion of a real wood-burning fire. In the preferred embodiment shown, the viewing panel 34 is comprised of clear glass. However, any transparent material can be utilized for the viewing panel 34. For example, clear or tinted acrylic could be used in lieu of glass. The glass panel may also be omitted. The glass panel can thus be made easily removable to permit cleaning, maintenance or repair of components within the firebox 36.

In another embodiment of the present invention, an artificial log and ember set 48 can be positioned in firebox 36 to further enhance the simulation of a wood-burning fireplace. As best seen in FIG. 5, the log and ember set 48 can include one or more artificial logs 50 supported by an ember bed 52. The logs 50 and the ember bed 52 may be molded from ceramic fiber by a vacuum forming process that is well known in the art. The logs 50 are shaped and colored to simulate the appearance of actual logs of any type. The ember bed 52 is shaped and colored to simulate the appearance of glowing, burnt and/or burning coals or embers.

Other materials can also be used to manufacture the artificial logs 50 and the ember bed 52. For example, these components can be molded from concrete, which provides for greater detail than can be achieved by using ceramic fiber. However, concrete is much heavier and is prone to breakage if accidentally dropped. The artificial logs 50 and ember bed 52 can also be made from other materials such as plastic, although plastic is not as realistic looking as either ceramic fiber or concrete. Preferably, the artificial logs 50 can be made as a hollow member out of styrene, or any suitable material, with a tinted plastic inlay for producing a glowing log effect when illuminated from inside or underneath.

In the illustrated embodiment, the artificial logs 50 are positioned above the ember bed 52. As best seen in FIG. 5, several locator pins 54 may extend upwardly from the top of the ember bed 52. These locator pins 54 coincide with indentations (not shown) in the bottom of logs 50 and assist in the proper alignment of the logs 50 on top of the ember bed 52. Alternatively, brackets (not shown) attached to the firebox 36 can support some or all of the logs 50. As will be explained below, proper alignment of the logs 50 on top of the ember bed 52 helps to create the appearance of an actual fire burning inside the firebox 36 of the fireplace assembly 10.

The ember bed 52 may be positioned on top of a metal grate and ember support 56, which is in turn supported by the bottom panel 42 of the firebox 36. The grate and ember support 56 has one or more grate openings 58 that coincide with apertures 60 in the ember bed 52. Openings 58 and apertures 60 allow light provided by a second light source 62 positioned beneath the firebox 36 to pass up through apertures 60 of the ember bed 52 so as to illuminate the underside of certain portions of the artificial logs 50 positioned thereabove. Some of the light that illuminates the underside of the artificial logs 50 may be redirected downwardly and back on to upper side of the ember bed 52. The illumination of the artificial logs 50 and the ember bed 52 is intended to create the appearance that the logs 50 and the ember bed 52 are glowing, thereby simulating an actual wood-burning fire above a bed of burning coals or embers. Of course, the number and configuration of the

grate openings 58 and apertures 60 depends on the positioning of the artificial logs 50 and the aesthetic effect desired.

A front edge 64 of the metal grate and ember support 56 projects upwardly from the bottom panel 42 of the firebox 36 to prevent light from leaking or spilling out from the underside of the ember bed 52, thereby destroying the illusion of an actual wood-burning fireplace. The front edge 64 of the grate and ember support 56 may also be shaped to resemble the type of grate often used in actual wood-burning fireplaces.

As best seen in FIG. 2, a second light source 62 for illumination of the artificial log and ember set is provided by one or more 60 watt incandescent light bulbs 66 positioned beneath the bottom panel 42 of the firebox 36. Bracket 68 attached to the housing bottom 16 of the fireplace housing 12 to support the light bulbs 66. The light bulbs 66 are connected to an electric power source 70 and to control unit 32, which may include one or more on/off rocker switch, or the like. A dimmer control (not shown) can also be provided the control unit 32 to permit the viewer to adjust the current flowing to the light bulb 66 to vary the degree of illumination. The electrical wiring (not shown) necessary to connect these components together is well known in the art.

A piece of reflective material (not shown), such as reflective or metalized plastic (such as Mylar™) can be positioned beneath and in front of the light bulbs 66 to reflect additional light up through the ember bed 52. The reflective material can be curved to increase the total amount of reflected light. The reflective material may also increase the area of the artificial log 50 that is illuminated by changing the point and angle of the second light source 62.

As best seen in FIG. 5, a translucent colored panel 74 positioned between the ember bed 52 and the grate and ember support 56 changes the color and intensity of the second light source 62. A red/orange panel of translucent plastic film is utilized to change the color of the incandescent light bulbs 66 to a color that simulates glowing embers.

It should be appreciated that the apparatus of the present invention is capable of being incorporated in the form of a variety of embodiments, only a few of which have been illustrated and described above. For example, aspects of the present invention could be incorporated in an electric fireplace designed to simulate a coal burning hearth of the type commonly used in Europe. Likewise, aspects of the present invention can be incorporated in other types of heating appliances such as electric simulated freestanding wood or coal burning stoves. Therefore, reference to a fireplace including aspects of the present invention will be understood to mean other types of heating appliances where a simulated flame as described herein is desired. Thus, the invention may be embodied in other forms without departing from its spirit of essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive, and the scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes that come within the meaning and range of equivalency of the claims are to be embraced within their scope.

WHAT IS CLAIMED IS:

1. A fireplace assembly comprising:

a housing;

a lenticular panel assembly positioned within said housing, said lenticular panel assembly including a lenticular panel and a mount attached thereto, said mount adapted to permit said lenticular panel to pivot about said mount; and

means for providing reciprocating motion to said lenticular panel through a predetermined range of motion.

2. The fireplace assembly of claim 1 wherein said means for providing reciprocating motion comprises:

an electric motor; and

a link member operatively connected to said electric motor, said link member connected to said lenticular panel for imparting said reciprocating motion to said lenticular panel.

3. The fireplace assembly of claim 1 wherein said means for providing reciprocating motion comprises:

an electric motor; and

a drive wheel operatively connected to said electric motor, said drive wheel being positioned to contact said lenticular panel for imparting said reciprocating motion to said lenticular panel.

4. The fireplace assembly of claim 3 wherein said electric motor is a variable speed motor.

5. The fireplace assembly of claim 3 wherein said drive wheel includes at least one cam lobe configured with a profile for urging said lenticular panel into said reciprocating motion.

6. The fireplace assembly of claim 5 wherein said drive wheel includes a plurality of cam lobes.

7. The fireplace assembly of claim 4 wherein said variable speed motor is adapted to rotate said lenticular panel in a period of about 1/2-15 seconds.

8. The fireplace assembly of claim 3 wherein said lenticular panel assembly includes a return member for providing a return bias to said lenticular panel.

9. The fireplace assembly of claim 8 wherein said return member is a spring extending between said housing and said lenticular panel.

10. The fireplace assembly of claim 1 including a first light source positioned between a back of said housing and said lenticular panel.

11. The fireplace assembly of claim 10 further comprising:

a simulated firebox positioned within said housing;

at least one artificial log positioned in said simulated firebox, said at least one artificial log having an exterior surface; and

a second light source positioned beneath said simulated firebox and positioned so as to illuminate at least a portion of said exterior surface of said at least one artificial log.

12. The fireplace assembly of claim 11 further comprising an artificial ember bed positioned beneath said at least one artificial log, wherein said second light source is positioned so as to illuminate at least a portion of said artificial ember bed.

13. The fireplace assembly of claim 11 wherein said artificial ember bed comprises a plurality of apertures positioned so as to permit light from said second light source to illuminate at least a portion of an exterior surface of said at least one artificial log.

14. The fireplace assembly of claim 13 further comprising a translucent colored panel positioned between said second light source and said at least one artificial log.

15. The fireplace assembly of claim 1 further comprising a heater assembly, said heater assembly including a blower and a heating element.

16. The fireplace assembly of claim 15 wherein said heater assembly is positioned between said simulated firebox and said housing.

17. The fireplace assembly of claim 1 wherein said lenticular panel includes images of a fire.

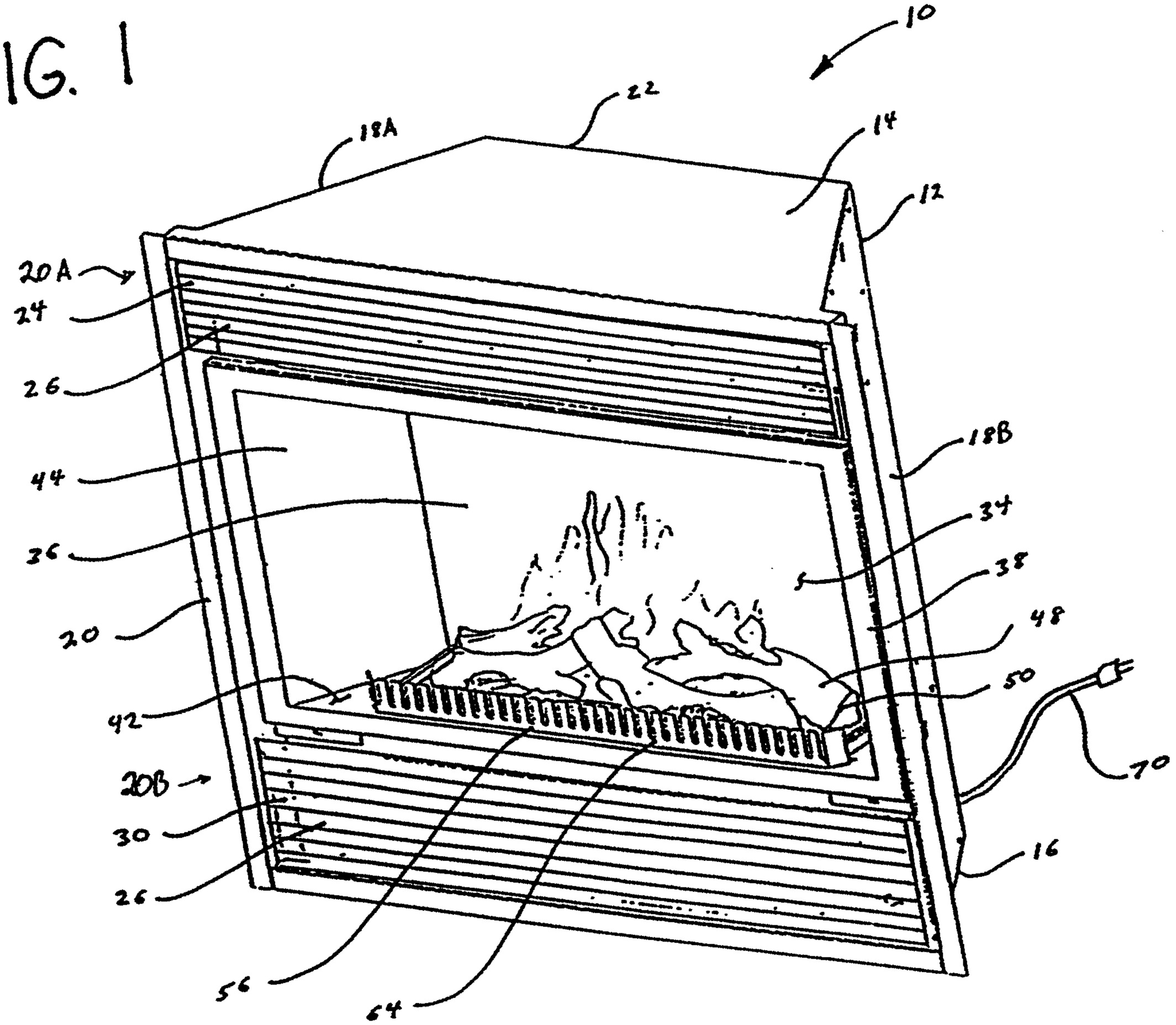
18. The fireplace assembly of claim 17 wherein said lenticular panel includes images of logs.

19. The fireplace assembly of claim 18 wherein said lenticular panel includes images of embers.

20. The fireplace assembly of claim 1 wherein said lenticular panel provides images of a burning wood fire.

21. The fireplace assembly of claim 1 wherein said lenticular panel provides images of a burning coal fire.

FIG. 1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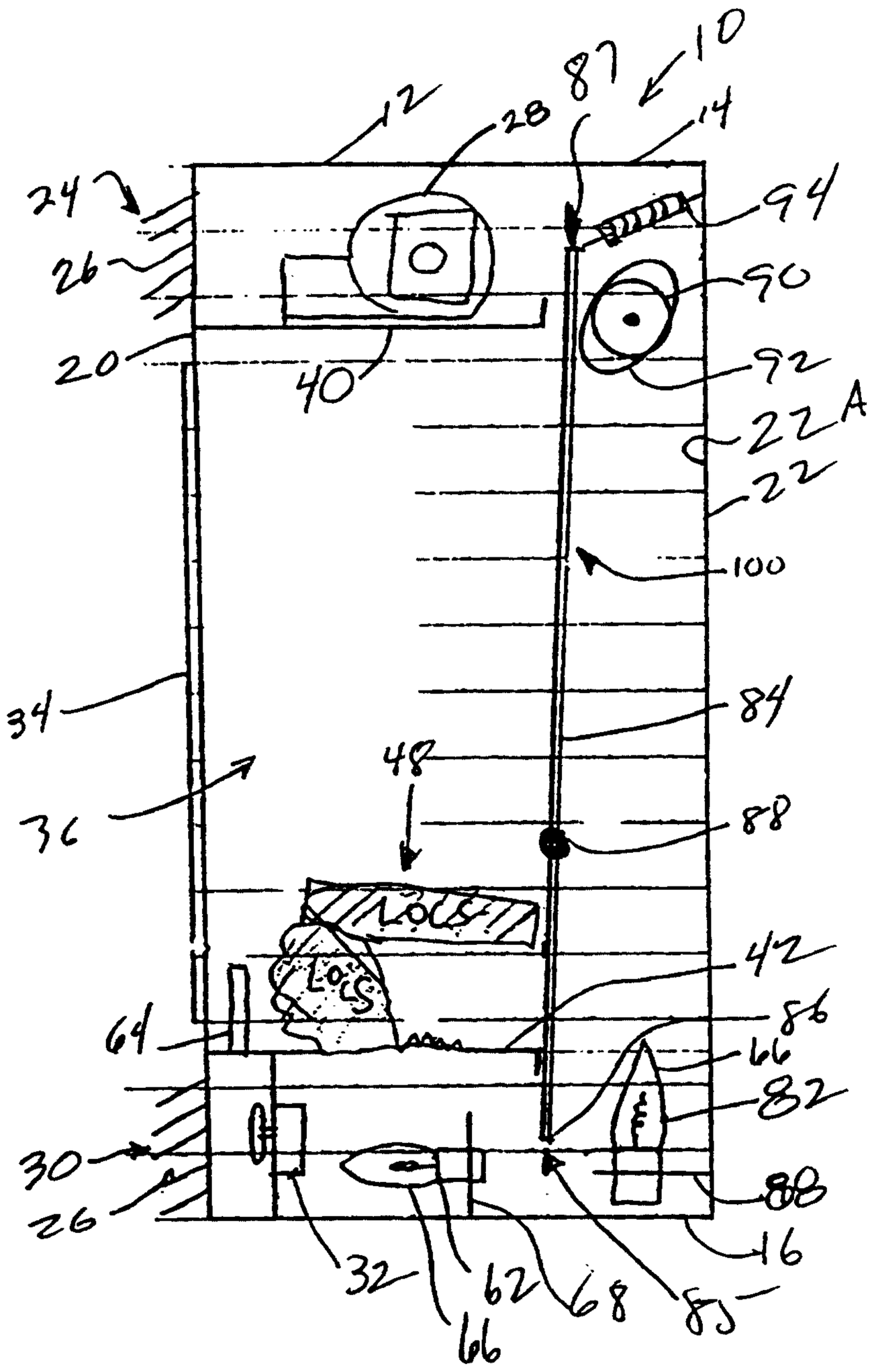
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FIG. 2

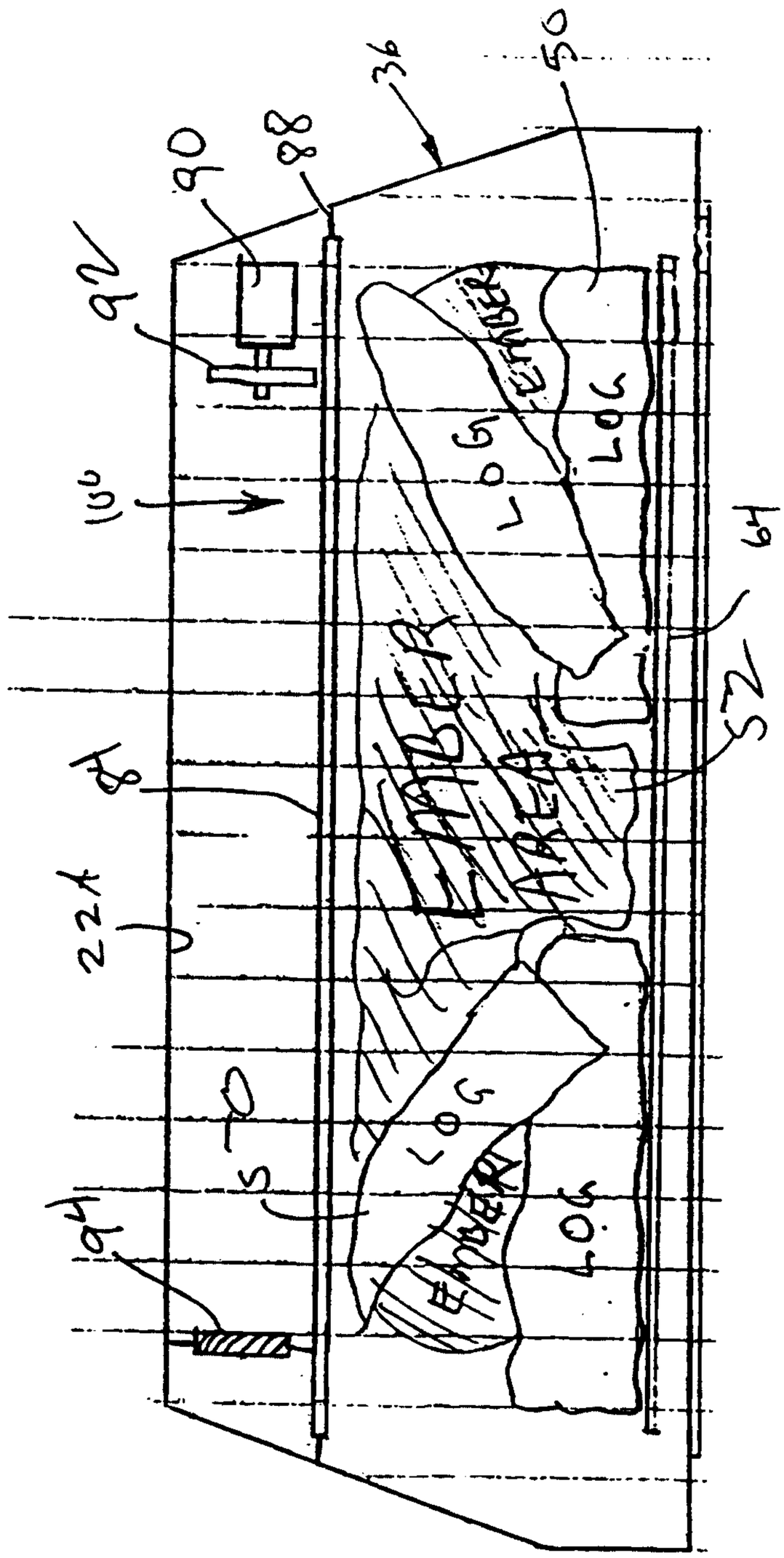
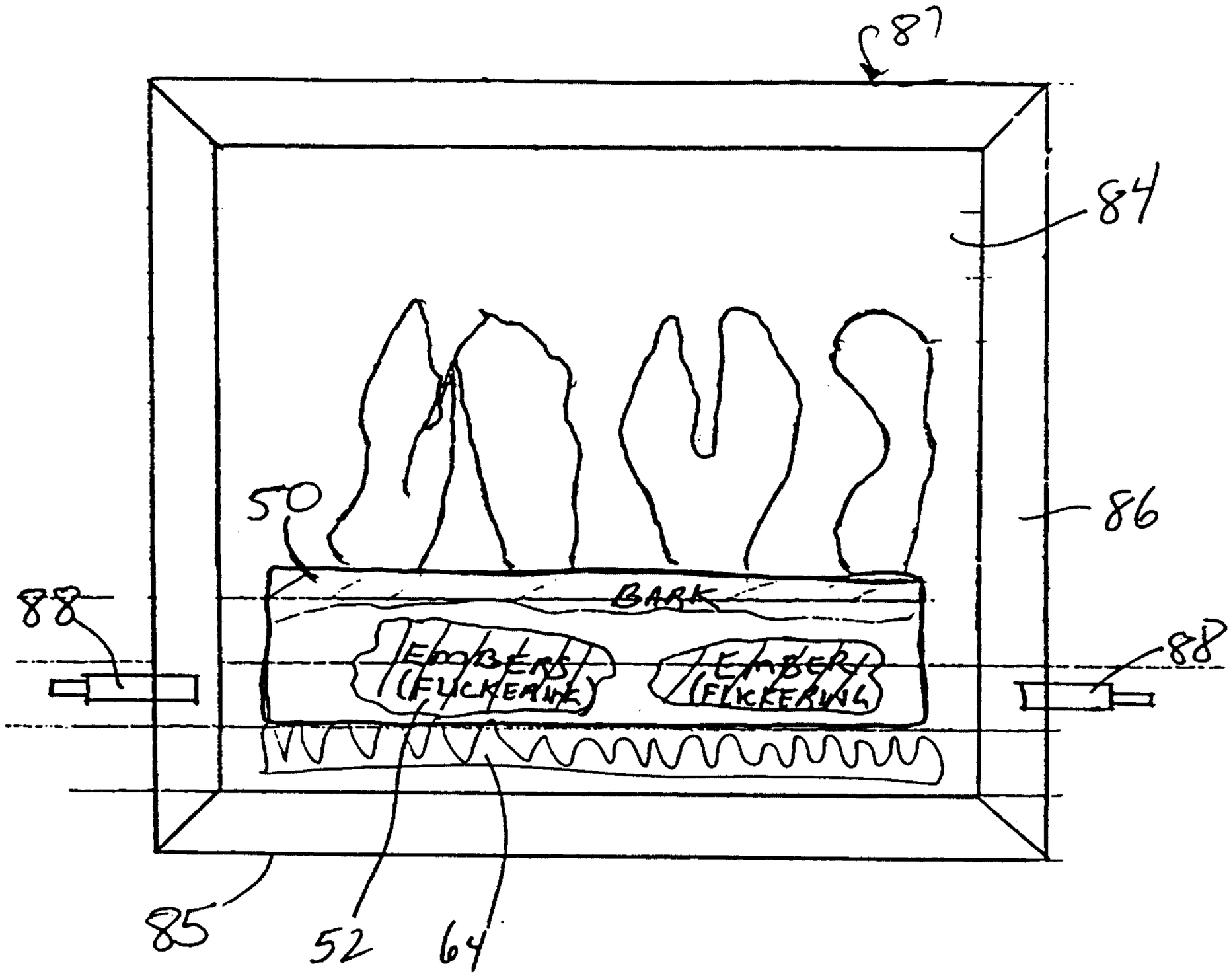


FIG. 3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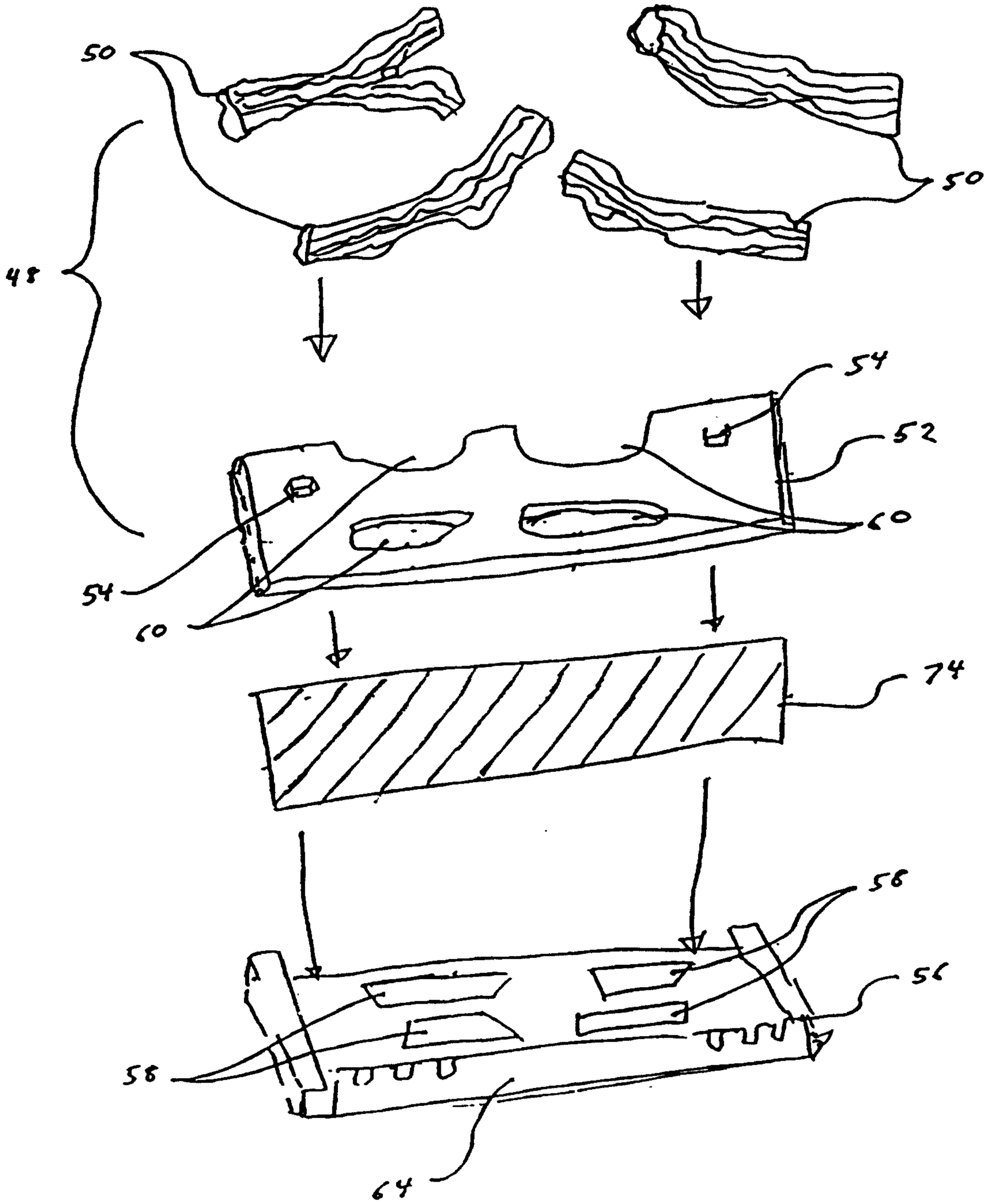
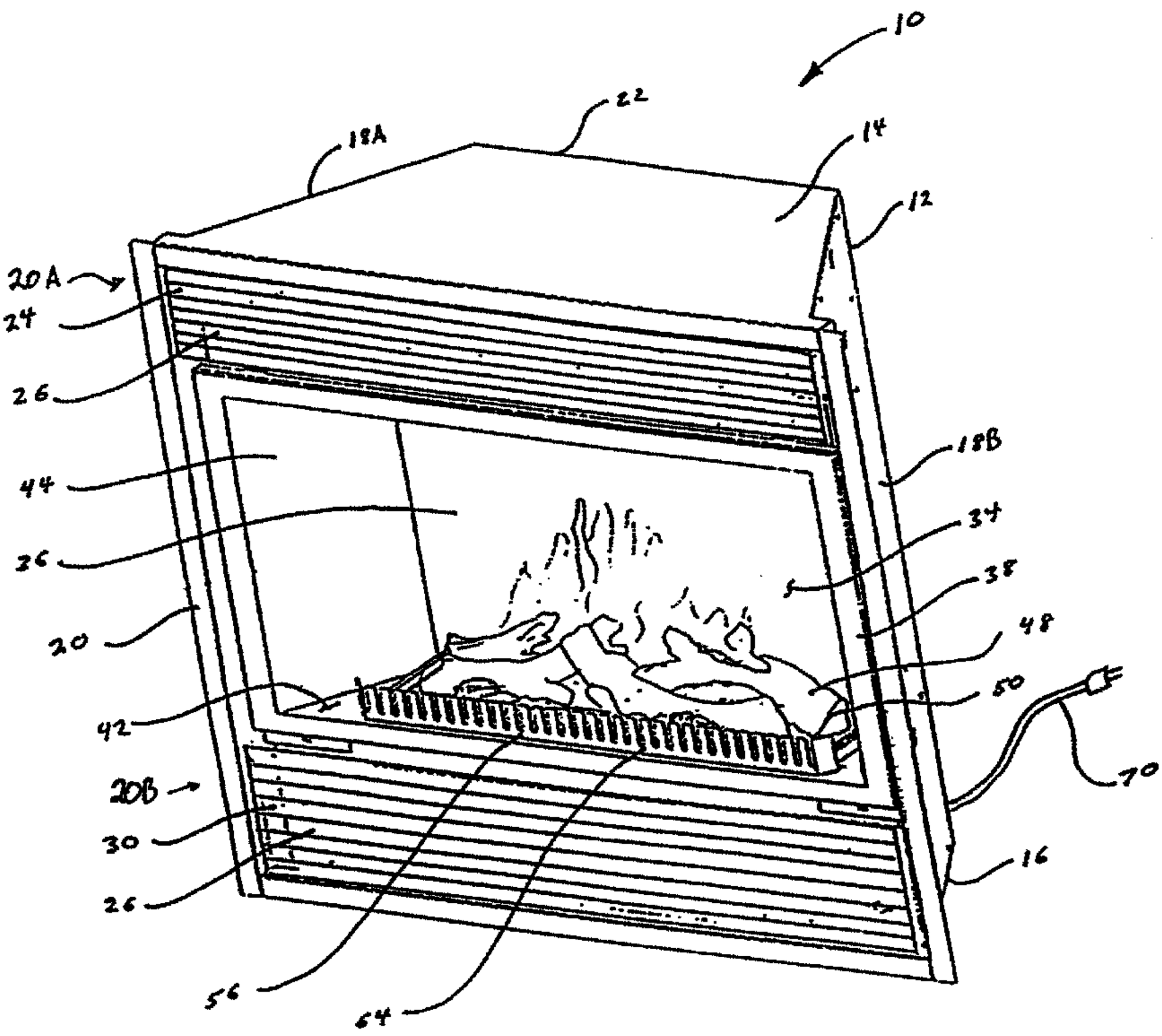
BARK
EMBERS (FLICKERING)
EMBERS (FLICKERING)
88
85
52
64

FIG. 4

FIG. 5

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