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(54) **SCREENLESS SIMULATED FLAME  
PROJECTION SYSTEM**

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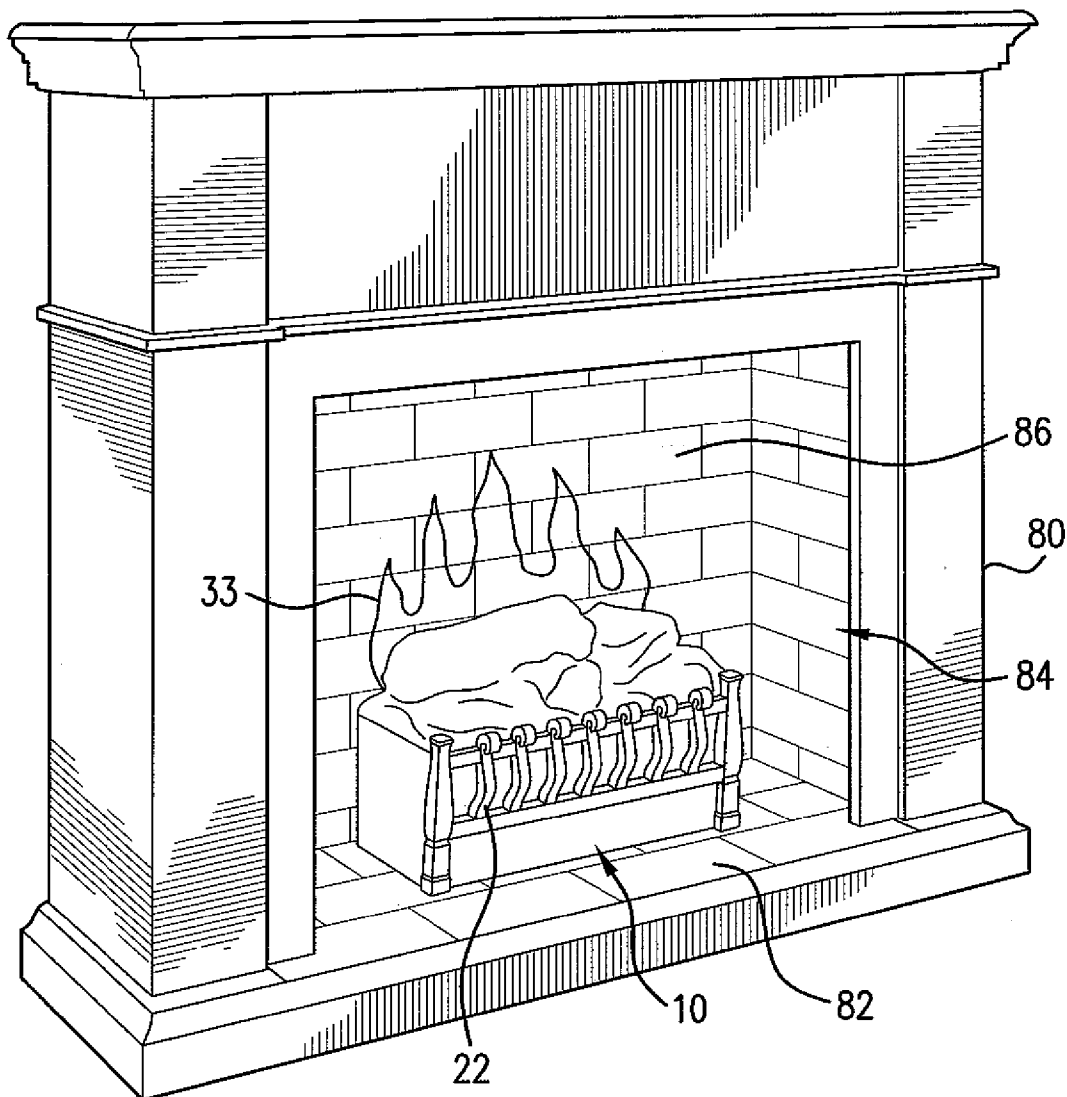
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(57) **ABSTRACT**

A standalone flame screenless flame projection device that can be removably seated in the hearth of a conventional or simulated fireplace includes a light projection system that can project a flame-like light onto the back panel of the fireplace to simulate the visual effects of an actual wood-burning fireplace.

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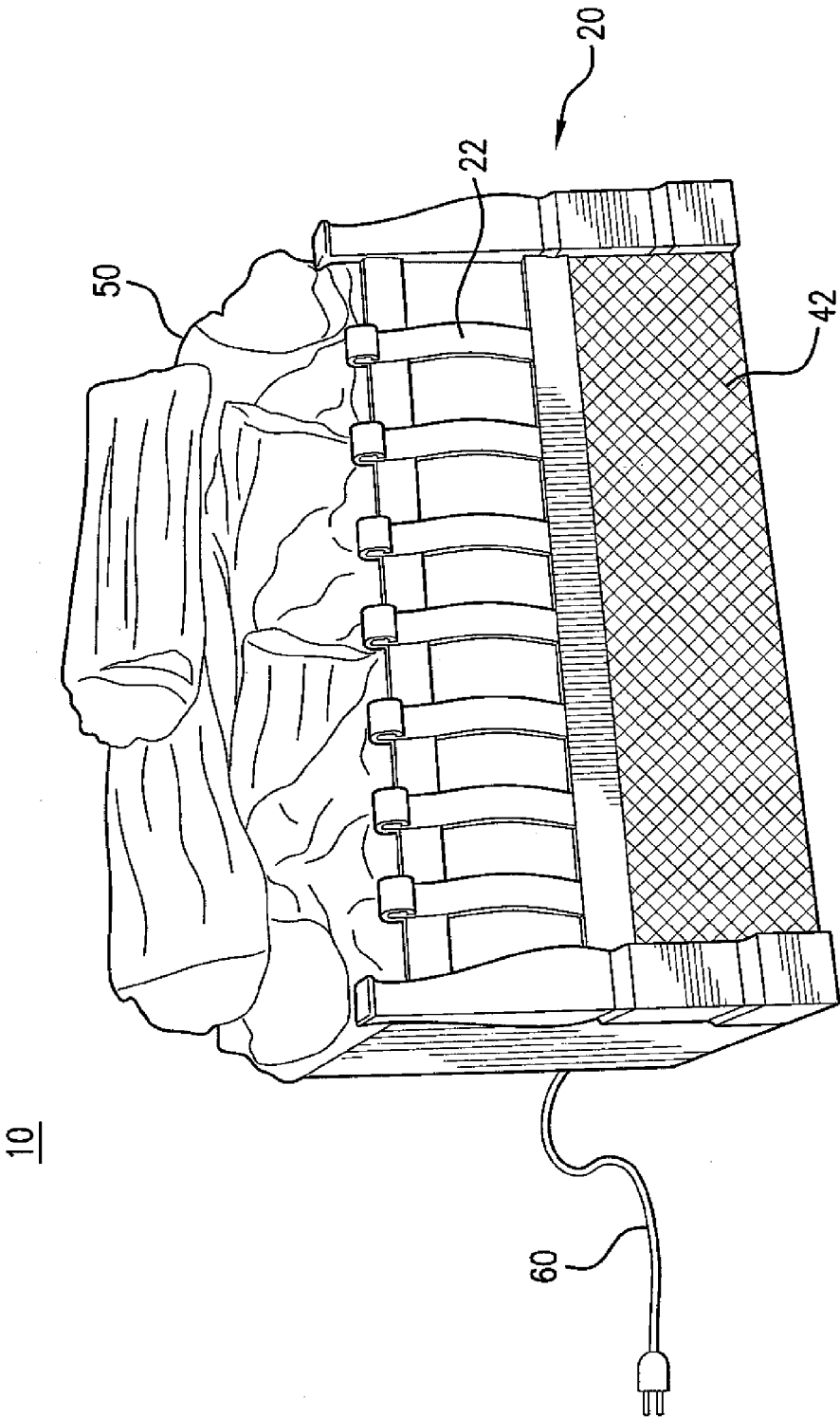


FIG. 1

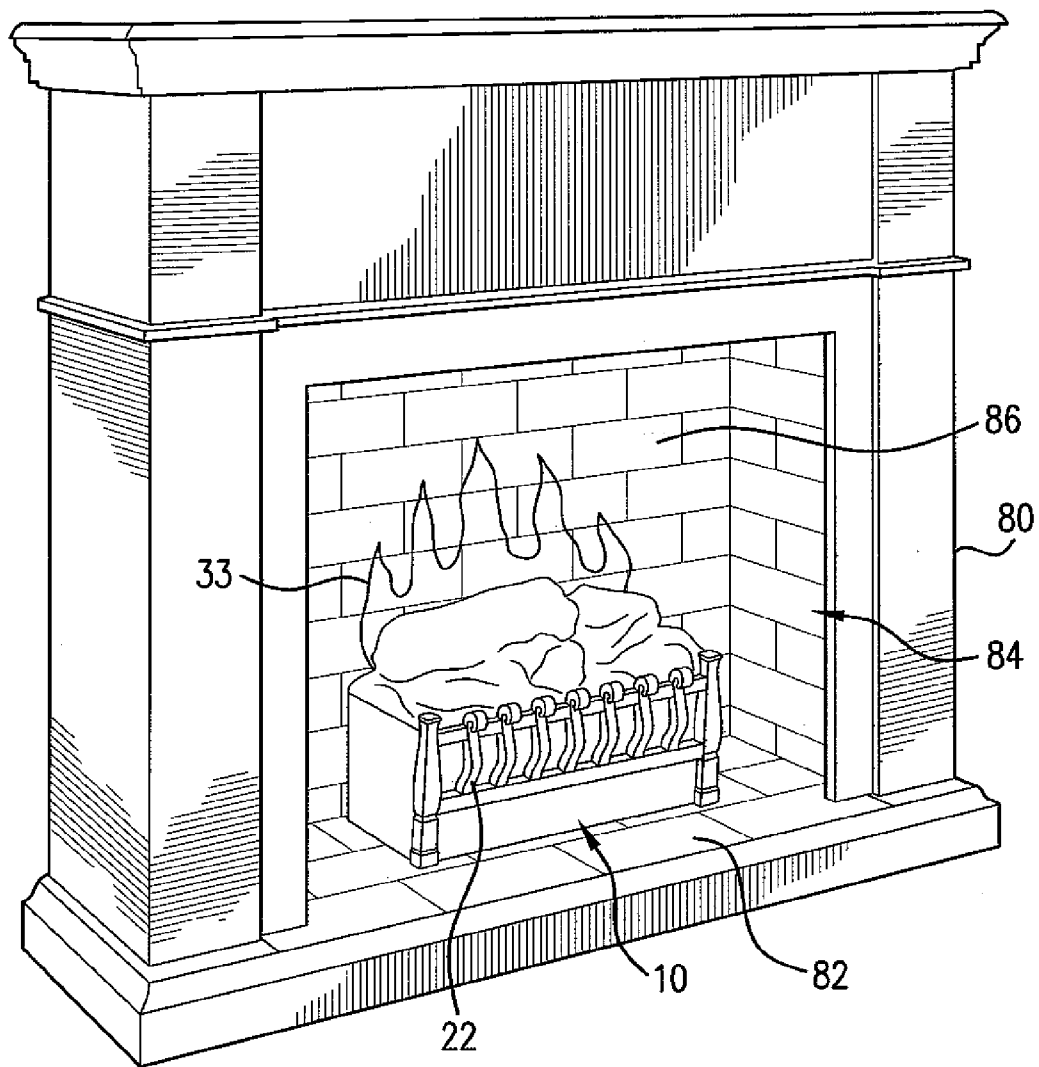


FIG. 2

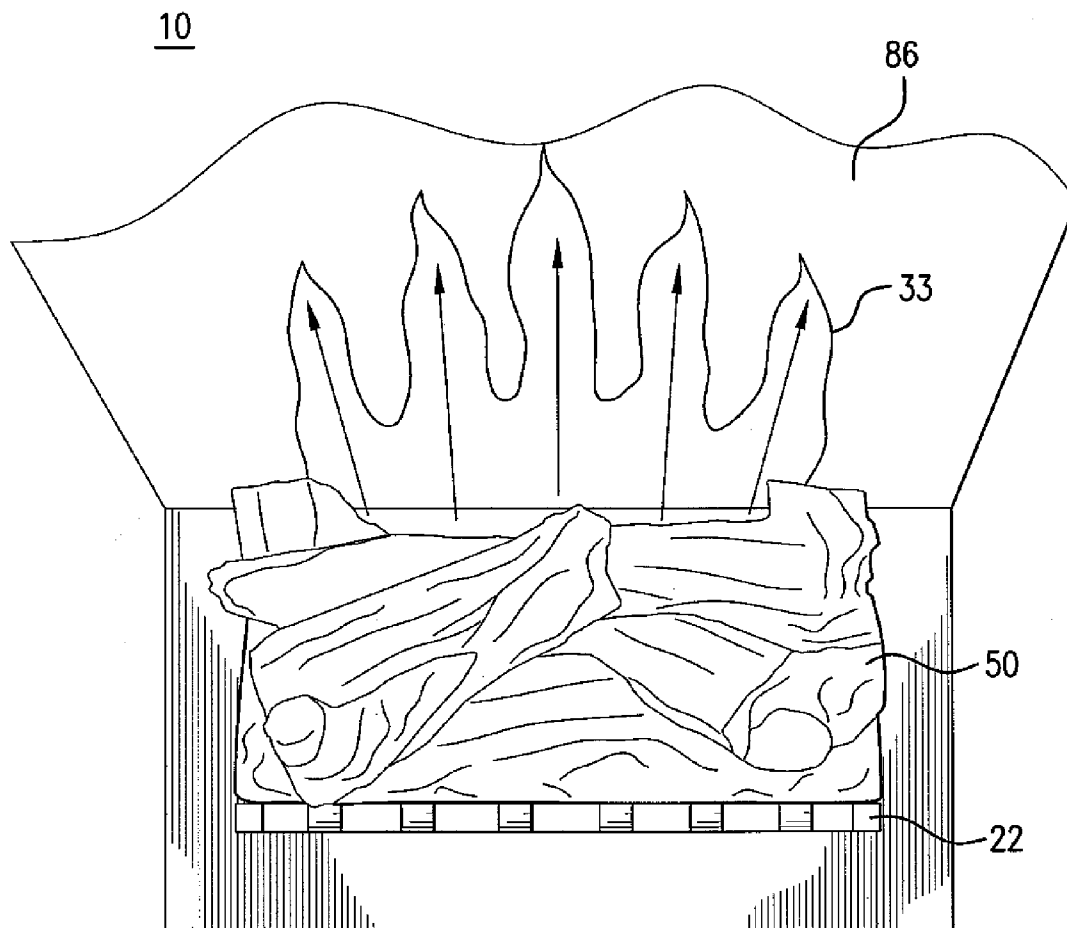


FIG. 3



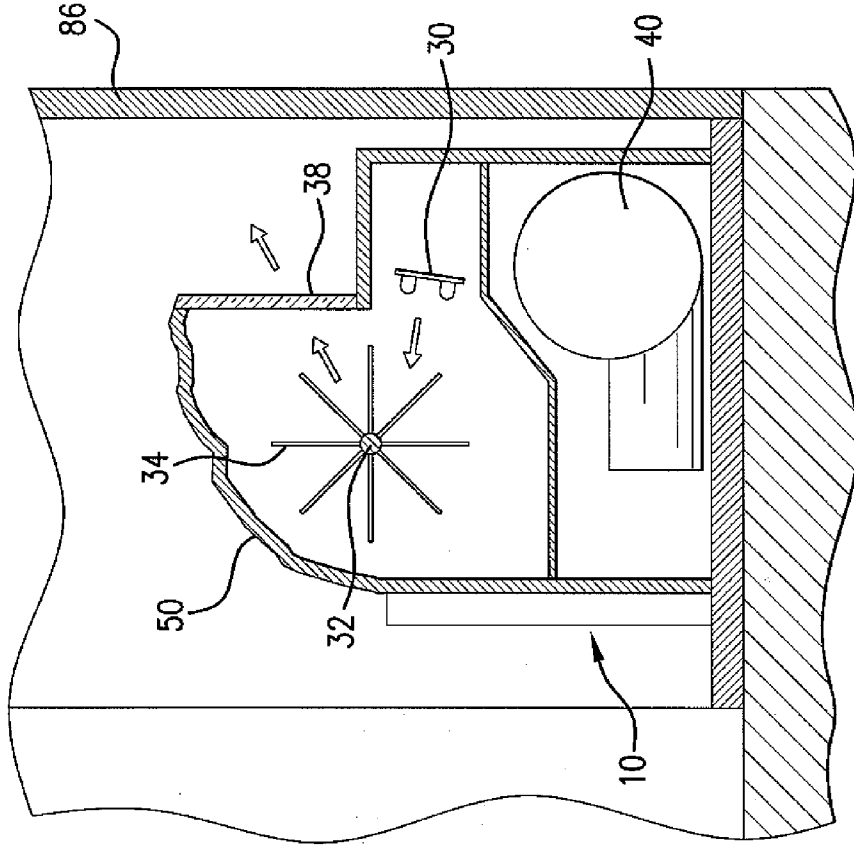


FIG. 5B

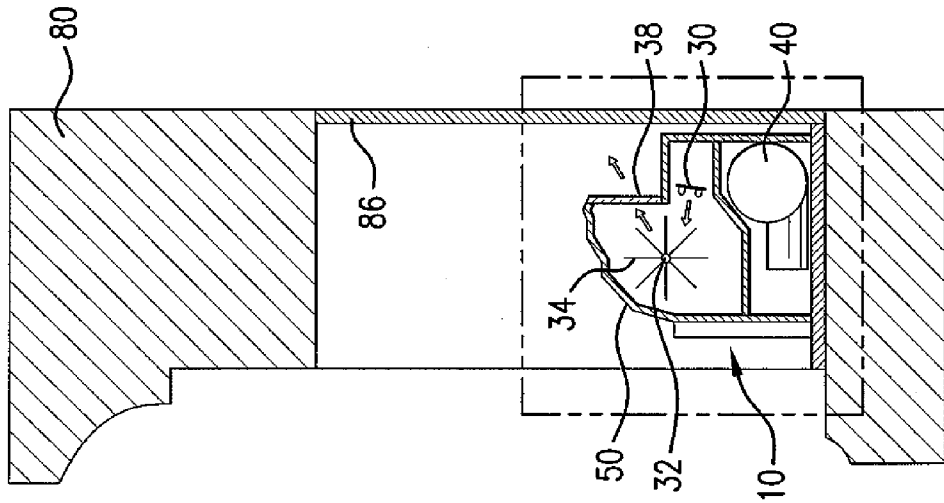


FIG. 5A

**SCREENLESS SIMULATED FLAME PROJECTION SYSTEM**

**FIELD OF THE INVENTION**

**[0001]** The invention relates generally to the field of fireplaces. More particularly, the invention relates to screenless flame projection devices that can be removably seated in the hearth of a fireplace and activated to project flame-like light onto the back panel of the fireplace to simulate the visual effects of an actual wood-burning fireplace.

**BACKGROUND**

**[0002]** Fireplaces are incorporated in to homes to provide a source of heat and for aesthetic reasons. There are currently several fireplace options available to consumers including traditional wood-burning fireplaces, gas burning fireplaces, and electric fireplaces. Real wood-burning fireplaces generally offer the greatest heat-production and aesthetics, but require more set-up and maintenance time to operate. Wood-burning fireplaces also present a safety hazard due to the risk of fire spreading into the home and can be inconvenient because logs must be provided. Gas-burning fireplaces offer a real flame and convenience, but lack the natural sound, flickering, and shadowing associated with wood fires. Gas-burning fireplaces also present safety hazards due to the risks of explosion associated with natural gas combustion. Electric fireplaces do not offer a real flame, but have many safety and convenience features.

**[0003]** Wood-burning fireplaces incorporated in dwelling are sometimes retrofitted to be gas burning or electric. Such retrofitted fireplaces retain much of their original aesthetics while offering better convenience and safety. The cost of retrofitting a wood-burning fireplace to gas or electric, however, is relatively high.

**SUMMARY**

**[0004]** The invention relates to the development of a standalone screenless flame projection device that can be removably seated in the hearth of a conventional fireplace and activated to front project flame-like light onto the back panel of the fireplace to simulate the visual effects of an actual wood-burning fireplace. The invention allows a wood-burning fireplace to be adapted to an electric fireplace without any retrofitting. It also can be used with a simulated fireplace that is not permanently installed in a dwelling. The screenless flame projection devices described herein differ structurally from the projection screen-dependent flame simulation systems that are integrated into conventional electric fireplaces in that they project light from the front of the fireplace to the back panel of the fireplace rather than projecting reflected light from the back of the fireplace onto a projection screen located in the middle section of the fireplace. The invention thus provides a lower cost and often more convenient alternative to conventional electric fireplaces.

**[0005]** The flame projection device can include a housing; a flame light system that can include a light source, a spindle having reflectors attached thereto, a mechanical device for rotating the spindle, and a flame cutout panel; a hot air generator, a simulated fuel source, a power source, and a controller. The flame light system and controller can be installed on the housing to form a self-contained unit (i.e., the flame projection device) capable of being positioned inside a firebox of the fireplace (e.g., by simply seating the device on the

hearth floor). Light produced by the light source can be projected onto the reflectors. As the spindle rotates, light is reflected off of the reflectors through one or more flame-shaped cut-out sections onto the rear wall of the firebox to simulate the “dancing” appearance of actual flames produced by burning wood. The flame projection device might also be used with a simulated fireplace that is not permanently installed in a dwelling.

**[0006]** Accordingly, the invention features a flame projection device for use with a real or simulated firebox comprising a hearth floor and rear wall. The flame projection device includes a housing; a flame light projection system incorporated in the housing and configured to project light in the form of simulated flames; and a controller for reversibly activating the flame light system. The housing can be reversibly positioned on the hearth floor and the flame light projection system can be activated to project simulated flames onto the rear wall of the firebox. The flame light projection device can lack a flame projection screen.

**[0007]** The flame light projection system can include a light source, a rotatable spindle, a plurality of reflectors, and a flame cutout panel, wherein the light source is arranged to direct light to the reflectors and the reflectors are arranged to reflect the light at the flame cutout panel. The housing can include a front portion and a rear portion, and the light source and flame cutout panel can be located in the rear portion of the housing and the rotatable spindle and reflectors can be positioned in the front portion of the housing.

**[0008]** The flame projection device might also include a simulated fuel source fastened to the top of the housing and/or a hot air generator positioned in the housing and controllable by the controller.

**[0009]** In another aspect, the invention features the combination of a real or simulated fireplace and a removable flame projection device, wherein the fireplace lacks a permanently attached means for simulating a flame, the fireplace includes a hearth and a back wall; and the flame projection device includes a housing, a flame light projection system incorporated in the housing and configured to project light in the form of simulated flames, and a controller for reversibly activating the flame light system. In the combination, the housing can be reversibly positioned on the hearth floor and the flame light projection system can be activated to project simulated flames onto the rear wall of the firebox. The flame light projection device can lack a flame projection screen.

**[0010]** In the combination of a real or simulated fireplace and a removable flame projection device, the flame light projection system can include a light source, a rotatable spindle, a plurality of reflectors, and a flame cutout panel; and the light source can be arranged to direct light to the reflectors and the reflectors are arranged to reflect the light at the flame cutout panel.

**[0011]** Another aspect of the invention features a method for projecting simulated flames onto the rear wall of a firebox. The method can include the steps of: (a) positioning a flame projection device on the floor of a hearth of the firebox; and (b) activating the flame light projection device to project simulated flames onto the rear wall of the firebox. In the method, the flame projection device can be inserted through the front of the firebox before being positioned on the floor of the hearth of the firebox. The flame light projection device can lack a flame projection screen.

**[0012]** Unless otherwise defined, all technical terms used herein have the same meaning as commonly understood by

one of ordinary skill in the art to which this invention belongs. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described below. All publications, patent applications, patents and other references mentioned herein are incorporated by reference in their entirety. In the case of conflict, the present specification, including definitions will control.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0013]** FIG. 1 is a perspective front view of a standalone screenless flame projection device.

**[0014]** FIG. 2 is a perspective view of the flame projection device of FIG. 1 seated within a fireplace.

**[0015]** FIG. 3 is a top view of the of the flame projection device of FIG. 1.

**[0016]** FIG. 4 is a cut-away view of the flame projection device of FIG. 1.

**[0017]** FIG. 5A is a sectional schematic view of the flame projection device of FIG. 1 shown seated within a fireplace.

**[0018]** FIG. 5B is a sectional schematic view of the flame projection device of FIG. 1 shown seated within a fireplace.

#### DETAILED DESCRIPTION

**[0019]** Referring now to FIGS. 1-5B, in one aspect, the invention provides a standalone screenless flame projection device 10 that may include a housing 20 with simulated grate 22, a light source 30, a spindle 32, reflectors 34, a mechanical device for rotating the spindle 36, a flame cutout panel 38, a hot air generator 40, a simulated fuel source 50, a power source 60, and a controller 70. As shown in FIGS. 2 and 5A, the standalone screenless flame projection device 10 can be removably placed into a fireplace 80 by seating the device on the floor of the hearth 82 of the firebox 84 with the simulated grate 22 facing outward and the projected simulated flame output being aimed at the back wall 86 of the firebox 84. Turning the flame projection device 10 on via the controller 70 causes the light from the light source 30 to be projected onto the reflectors 34 as they rotate with the spindle 36. The light reflected from the reflectors 34 is then passed through the flame cutout panel 38 and projected onto the back wall 86 of the firebox 84 as simulated flames 33 as shown in FIGS. 2 and 3.

**[0020]** The flame projection device 10 is preferably sized to fit within a conventional firebox, e.g., with a footprint similar to or slightly larger than a conventional fuel source grate. For example, the flame projection device 10 may have a width between 25-100 cm, a height of between 10-100 cm, and a depth of between 12 and 50 cm (e.g. 38×28×20 cm+/-10%). To provide a good flame effect, the rear portion 26 of the housing 20 is preferably positioned the floor of the hearth 82 about 0 to 45 cm (more preferably, 0.5-10 cm or less than 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 25, 30, 35, or 40 cm) from the back wall 86 of the firebox 84. The weight of the flame projection device 10 should be light enough for the average person to transport, e.g., less than 20, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, or 3 kg.

**[0021]** The housing 20 can take the form of any device suitable for holding the other components of the flame projection device 10 in a working configuration. Preferably, the housing 20 is arranged as shown in FIG. 4 with a front portion 23 (including the simulated grate 22), a bottom portion 24, side portions 25a and 25b, and a rear portion 26, which

together define an interior compartment 28. The frontal portion of the housing 20 may, for example, be arranged to simulate the appearance of a conventional fuel source grate, e.g., by including the simulated grate 22. The side portions 25a, 25b and the rear portion 26 of the housing 20 may be arranged as flat panels that may have a quadrangular or other polygonal or irregular shape. Preferably, the simulated grate 22 is large enough to hide much of the other outer portions of the housing 20 from being observed from a viewer positioned in front of the fireplace 80 into which flame projection device 10 is seated. The housing 20 may be made of any suitably rigid material, e.g., metal, plastic, poly-resin, wood, or engineered wood (MDF or particle board). In embodiments of the flame projection device 10 that include a hot air generator, for safety reasons, the housing 20 is preferably made of a heat-resistant material such as metal.

**[0022]** The interior compartment 28 is accessible through a relatively large opening 29 in the top of the housing 20. The light source 30, spindle 32, reflectors 34, mechanical device for rotating the spindle 36, flame cutout panel 38, and hot air generator 40 can be accessible through the opening 29 and might be installed during the fabrication of the flame projection device 10 therethrough. As illustrated in FIG. 1, the front portion 23 of housing 20 might also include a screen 42 through which heated air is passed through from the hot air generator 40.

**[0023]** The simulated fuel source 50 can be installed on the top of the housing 20 over the opening 29. The simulated fuel source 50 can be made from synthetic materials (e.g., plastic) to resemble the appearance of a traditional fuel source (e.g., wood or coal) or a series of stones. In some embodiments, the simulated fuel source 50 includes a plurality of light transmitting portions (e.g., transparent or translucent regions) that allows light from a light source 30 installed in the housing 20 to illuminate the outer surface of the simulated fuel source 50 in a pattern similar to a traditional fuel source (e.g., with several different regions having different light intensity which may follow the cracks and crevices of the simulated fuel source 50).

**[0024]** As illustrated in FIG. 4, the reflectors 34 of the spindle 32 may be shaped as finger-like projections. The spindle 32 may be rotated by mechanical device for rotating the spindle 36. The light source 30 can be any suitable lighting device such as incandescent light bulbs, gas discharge lamps, or light emitting diodes (LEDs). The light source 30 is preferably selected to emit light of colors similar to those from a burning fuel source (e.g., reds, yellows, oranges, blues, and violets), although filters might be used for this purpose as well (e.g., to selectively transmit the reds, yellows, oranges, blues, and violets within a white light source). Where the light source 30 includes LEDs, these LEDs may be located in different positions within the housing 20, e.g., different sets of LEDs can be mounted in a straight line to direct light toward the spindle 32 and reflectors 34.

**[0025]** As shown in FIGS. 4 and 5B, the flame cutout panel 38 can be interposed between the light source 30 and the back wall 86 of the firebox 84. The flame cutout panel 38 can be made of a panel of light-blocking material having one or more portions therein cut out in the pattern of flames as shown in FIG. 4. The flame cutout panel 50 thus acts as a stencil that forms the light reflected of the spindle 36 into simulated flames 33 before it hits the back wall 86 of the firebox 84.

**[0026]** Referring to FIGS. 5A and 5B, the flame projection device 10 can optionally include the hot air generator 40



within the housing **20**. The hot air generator **40** preferably includes an electrically powered heating element and a blower fan. The controller **70** may be used to adjust and control the temperature of the heated air that is generated as well as fan speed. A thermostat may be used to adjust and control the temperature of the heated air. The hot air generator **40** as well as other components of the flame projection device **10** can be powered by power source **60** which can take the form of a connection to any conventional power source (e.g., a household electrical source or battery).

[0027] The controller **70**, which can be used to control the operation of the light source **30**, may be any suitable controller such as, for example, a computer and software, an electric circuit, or one or more manual switches. The controller **70** can also be used to control other features of the electric fireplace such as, for example, the hot air generator **40**, a timer, an audio system and an on/off power switch.

[0028] In some embodiments, the flame projection device **10** might also include an audio system for projecting sound that resembles the sound of actual burning wood. For example, crackling sounds that may be stored on a memory chip and emitted by an audio speaker on the housing **20** to simulate the sparks and associated crackling noise of burning embers.

[0029] The power source **60** can be any safe and suitable source of power such as for example, an electrical connection to a home's electrical system via connection to an outlet, or connection to one or more batteries.

[0030] As shown in FIG. 2, the screenless flame projection device **10** might also be included in a kit that further features a simulated fireplace **80**. Although the simulated fireplace **80** might include a firebox **84** having a back wall **86** that is made of a material (such as a plastic screen) to enhance the appearance of the simulated flames **33** projected thereon by the flame projection device **10**, the flame projection device **10** is typically arranged to project simulated flames without requiring a screen, so that the back wall **86** can be fashioned to simulate the aesthetics of the back wall of a conventional fireplace firebox, e.g., simulated brick, stone, firebrick, antique brick, or painted concrete.

[0031] The invention also provides methods for simulating flames in a fireplace using a standalone screenless flame projection device such as described above. The method can include the steps of positioning a standalone screenless flame projection device in a firebox in a fireplace and operating the device to project simulated flames against the back wall of the firebox. In one embodiment, the standalone screenless flame projection device can include a light source having multiple different sets of lights placed at different locations of the flame projection device and/or pointed at different locations in the firebox and the method can include a step of controlling each different set of lights separately, e.g., in a controlled or random sequence.

#### OTHER EMBODIMENTS

[0032] It is to be understood that while the invention has been described in conjunction with the detailed description thereof, the foregoing description is intended to illustrate and not limit the scope of the invention, which is defined by the scope of the appended claims. Other aspects, advantages, and modifications are within the scope of the following claims.

What is claimed is:

1. A flame projection device for use with a real or simulated firebox comprising a hearth floor and rear wall, the flame projection device comprising:

a housing;

a flame light projection system incorporated in the housing and configured to project light in the form of simulated flames; and

a controller for reversibly activating the flame light system; wherein the housing can be reversibly positioned on the hearth floor and the flame light projection system can be activated to project simulated flames onto the rear wall of the firebox.

2. The flame projection device of claim 1, wherein the flame light projection system comprises a light source, a rotatable spindle, a plurality of reflectors, and a flame cutout panel, wherein the light source is arranged to direct light to the reflectors and the reflectors are arranged to reflect the light at the flame cutout panel.

3. The flame projection device of claim 2, wherein the housing comprises a front portion and a rear portion, and the light source and flame cutout panel are located in the rear portion of the housing and the rotatable spindle and reflectors are positioned in the front portion of the housing.

4. The flame projection device of claim 1, further comprising a simulated fuel source fastened to the top of the housing.

5. The flame projection device of claim 1, further comprising a hot air generator positioned in the housing and controllable by the controller.

6. The flame projection device of claim 1, wherein the flame light projection system does not comprise a flame projection screen.

7. The combination of a real or simulated fireplace and a removable flame projection device, wherein the fireplace lacks a permanently attached means for simulating a flame, the fireplace comprising a hearth and a back wall; and

the flame projection device comprising a housing, a flame light projection system incorporated in the housing and configured to project light in the form of simulated flames, and a controller for reversibly activating the flame light system;

wherein the housing can be reversibly positioned on the hearth floor and the flame light projection system can be activated to project simulated flames onto the rear wall of the firebox.

8. The combination of a real or simulated fireplace and a removable flame projection device of claim 7, wherein the flame light projection system comprises a light source, a rotatable spindle, a plurality of reflectors, and a flame cutout panel, wherein the light source is arranged to direct light to the reflectors and the reflectors are arranged to reflect the light at the flame cutout panel.

9. The combination of a real or simulated fireplace and a removable flame projection device of claim 8, wherein the housing comprises a front portion and a rear portion, and the light source and flame cutout panel are located in the rear portion of the housing and the rotatable spindle and reflectors are positioned in the front portion of the housing.

10. The combination of a real or simulated fireplace and a removable flame projection device of claim 7, further com-

prising a simulated fuel source fastened to the top of the housing.

**11.** The combination of a real or simulated fireplace and a removable flame projection device of claim 7, further comprising a hot air generator positioned in the housing and controllable by the controller.

**12.** The combination of a real or simulated fireplace and a removable flame projection device of claim 7, wherein the flame light projection system does not comprise a flame projection screen.

**13.** A method for projecting simulated flames onto the rear wall of a firebox, the method comprising the steps of:

- (a) positioning a flame projection device on the floor of a hearth of the firebox; and

- (b) activating the flame light projection device to project simulated flames onto the rear wall of the firebox.

**14.** The method of claim 13, wherein the flame projection device is inserted through the front of the firebox before being positioned on the floor of the hearth of the firebox.

**15.** The method of claim 13, wherein the flame projection device comprises a housing, a flame light projection system incorporated in the housing and configured to project light in the form of simulated flames, and a controller for reversibly activating the flame light system.

**16.** The method of claim 13, wherein the flame light projection system does not comprise a flame projection screen.

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