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Potter(10) **Pub. No.: US 2014/0290643 A1**(43) **Pub. Date: Oct. 2, 2014**(54) **HELICAL FUEL BURNER**(71) Applicant: **Stephen Potter**, San Francisco, CA (US)(72) Inventor: **Stephen Potter**, San Francisco, CA (US)(21) Appl. No.: **14/073,836**(22) Filed: **Nov. 6, 2013****Related U.S. Application Data**

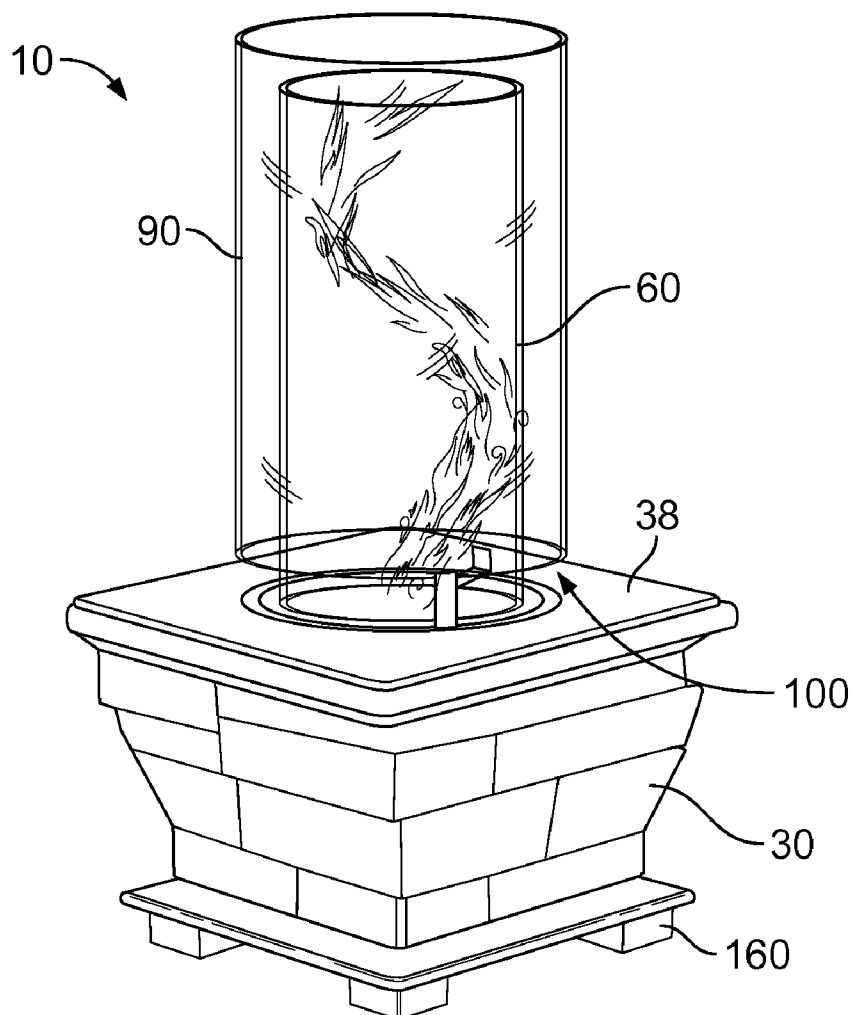
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(57)

ABSTRACT

A burner for consuming a fuel includes a base with a lower end, an upper end, and at least one side wall. A fuel inlet port of the upper end of the base includes at least an inner wall and a bottom wall. At least one helical conduit is fixed outside of the inner wall of the fuel inlet port and conveys air from an open lower end thereof to an opposing open top end thereof at the upper end of the base. A bottom end of an annular glass burning chamber is fixed with the upper end of the base, such that the second end of the at least one conduit terminates therebetween. As such, the fuel in the fuel inlet port mixes with the air entering the burning chamber from the at least one helical conduit and burns in a helical pattern within the burning chamber.



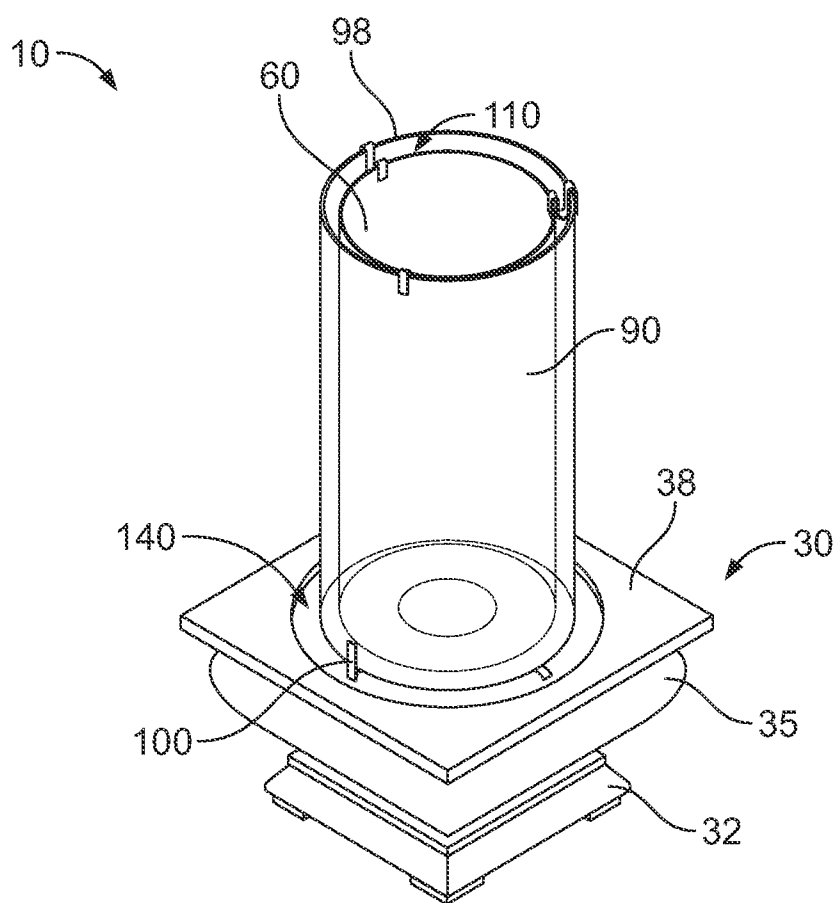


FIG. 1

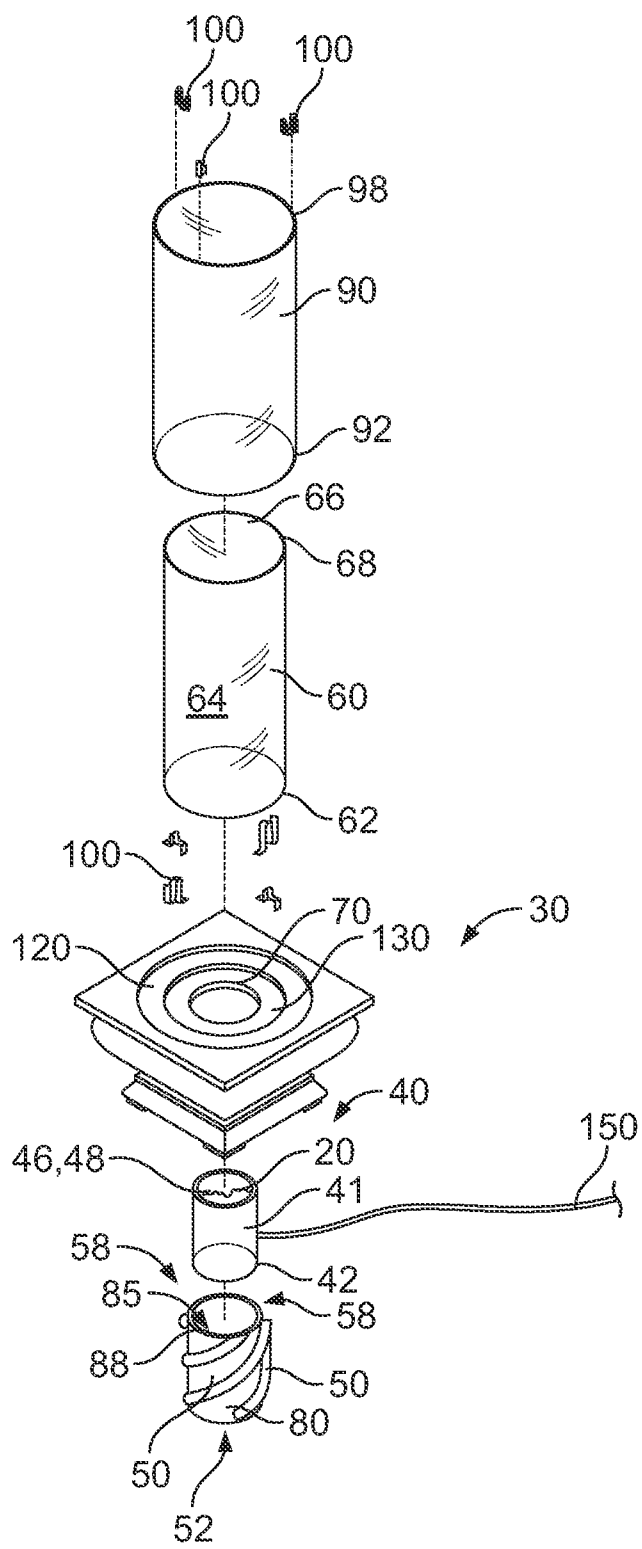


FIG. 2

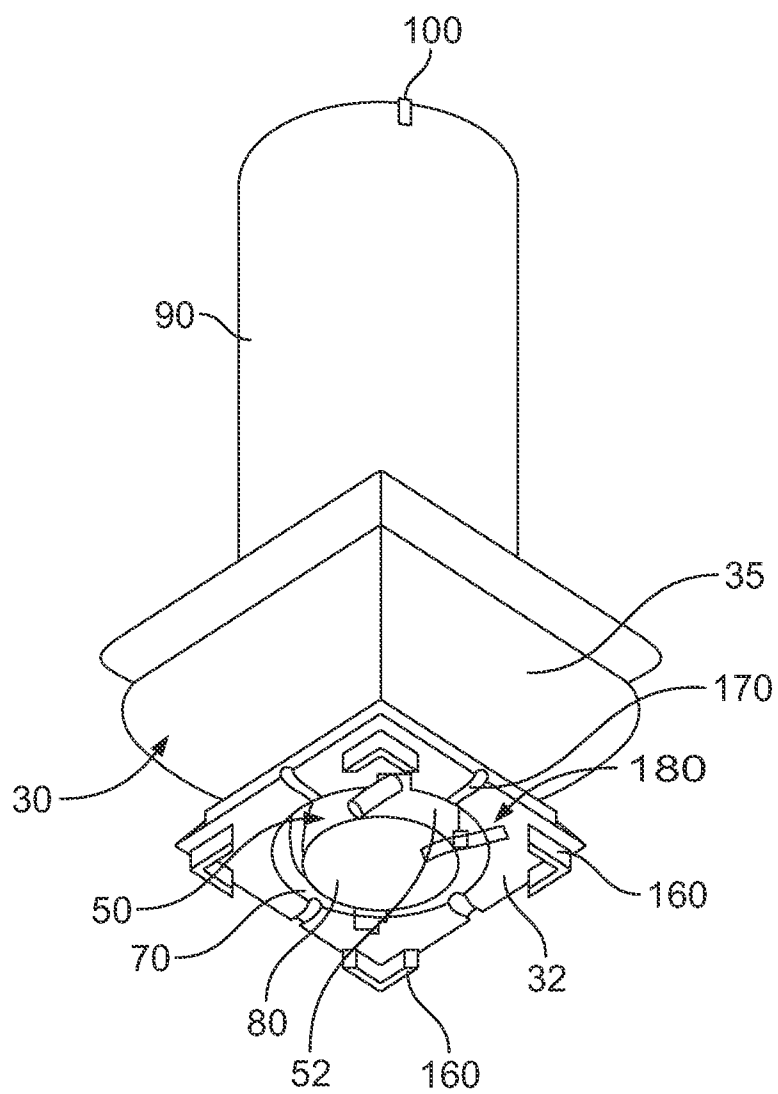


FIG. 3

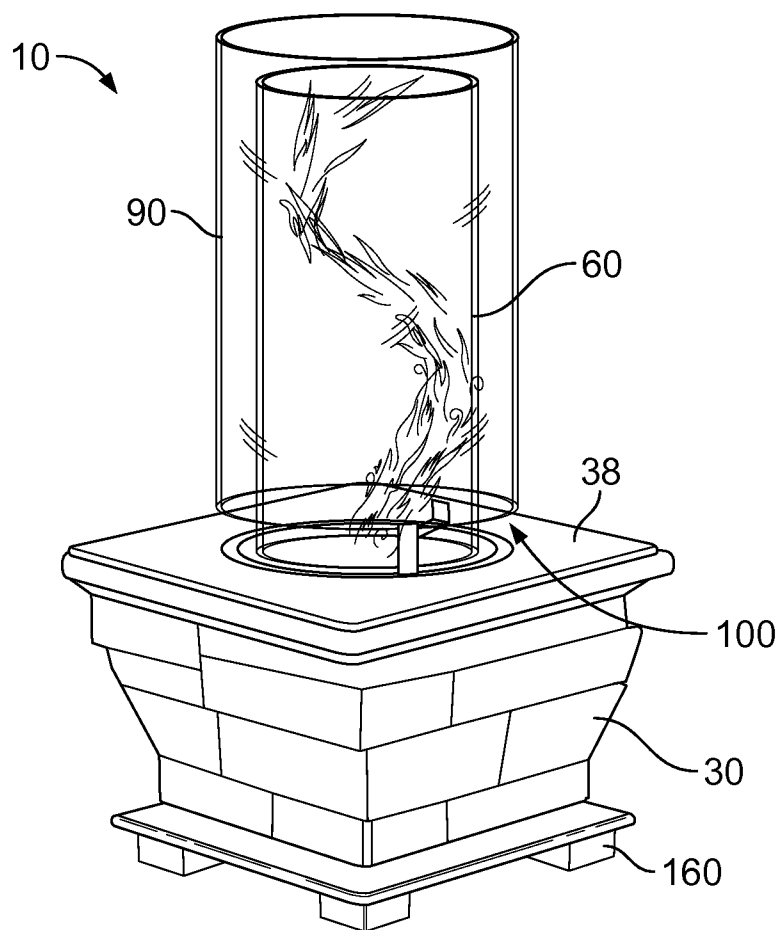


FIG. 4

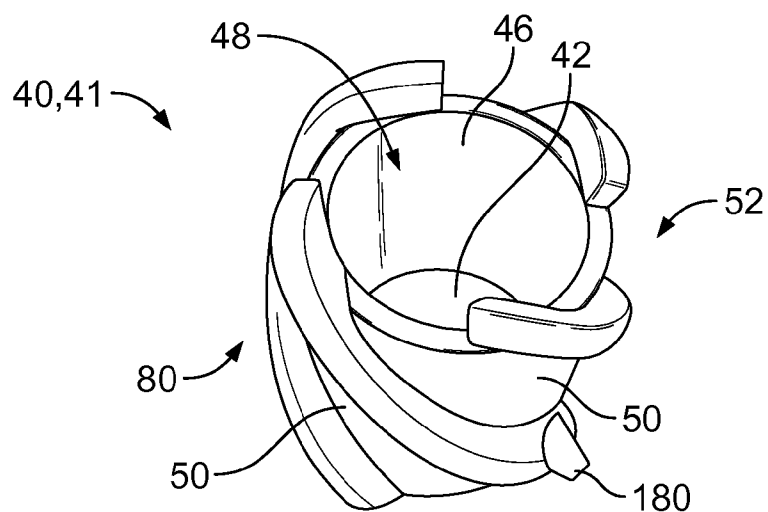


FIG. 5

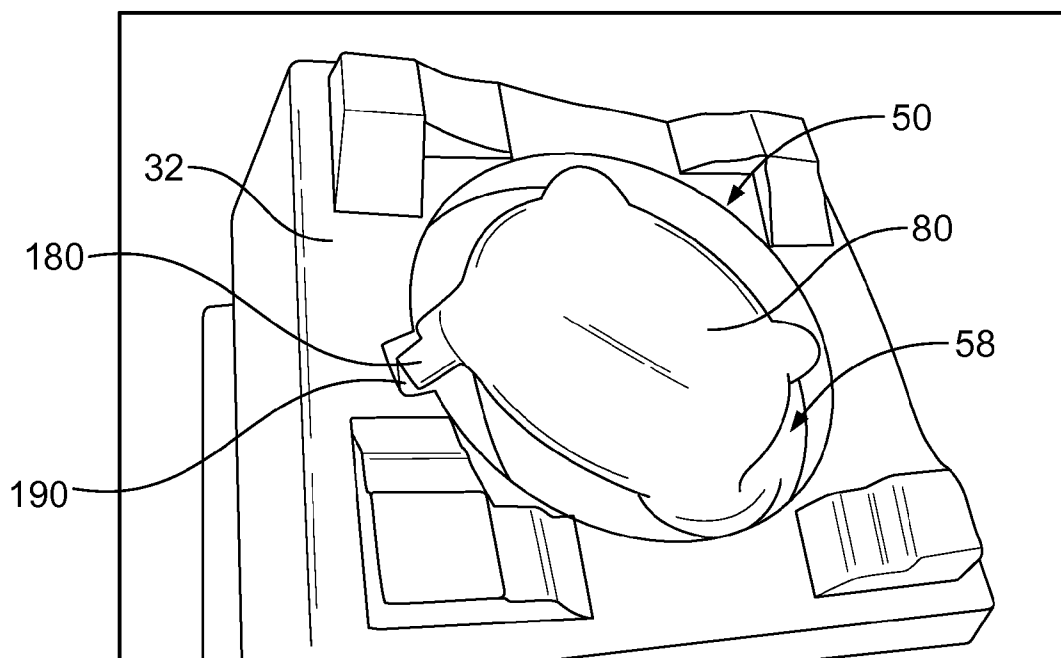


FIG. 6

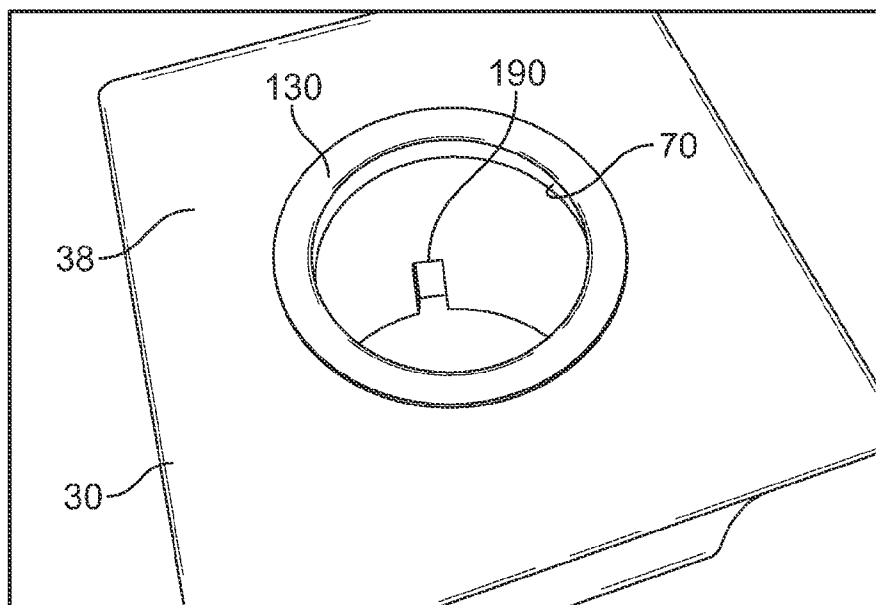


FIG. 7

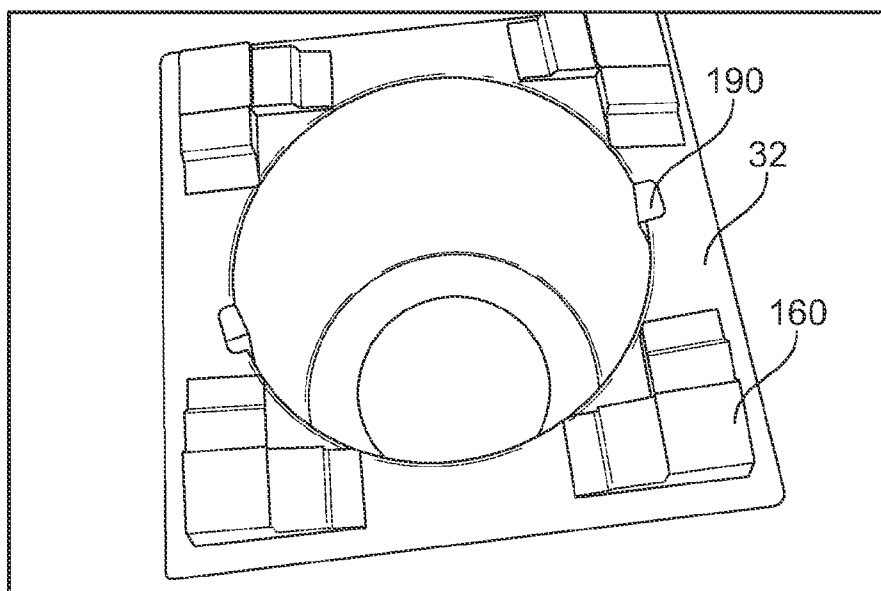


FIG. 8

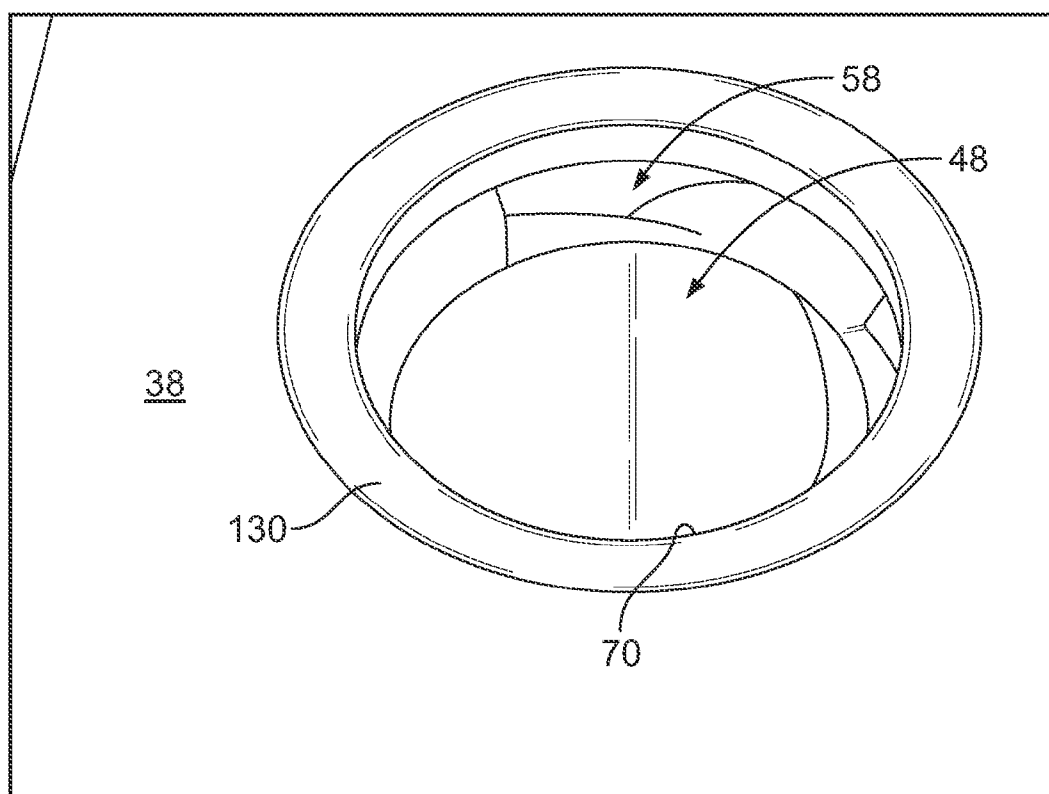


FIG. 9

HELICAL FUEL BURNER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application 61/806,852, filed on Mar. 30, 2013, included herein by reference.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH AND DEVELOPMENT

[0002] Not Applicable.

FIELD OF THE INVENTION

[0003] This invention relates to burning chambers, and more particularly to an aesthetically pleasing burning chamber that produces an elongated spiral flame effect.

DISCUSSION OF RELATED ART

[0004] Campfires and fire pits have long been enjoyed by people who find it relaxing and interesting to look at the flames of the fire. Often a larger fire is more interesting, but of course an open campfire or fire pit with a larger fire also becomes more dangerous for a variety of reasons, such as the risk of neighboring structures or foliage catching on fire, burns, and the like.

[0005] Conventional gel-fuel type burners are also known in the art, but such a fuel produces a relatively small and visibly weak flame. Gel-fuel type burners are quite convenient, however, in that their fuel containers are easier to use than other fuels such as wood.

[0006] One product currently available by Outdoor Greatroom Company, marketed under the brand name "Serenity-K Table Top Firepit," and described in US 2012/0006316 to Shimek et al. on Jan. 12, 2012, produces a vortex flame pattern by using a plurality of radially-spiraling air vanes above a fuel container and below a burning chamber to impart a spinning motion to air entering the burning chamber. Such air is heated in the burning chamber and a vortex-shaped flame results. However, in such a product the air-intake assembly is visible, and the air that enters the burning chamber is introduced thereto laterally with no upward vertical velocity. The heat of the flame is what imparts an upward velocity to the air with this type of product. An even taller and more vibrant flame could be accomplished if the air entering the burning chamber already had a vertical direction, but such is not possible with the Shimek et al. device.

[0007] Another device taught in EP 2098781 to Werner Abele of Germany, on Mar. 5, 2008, teaches a similar device wherein the burning chamber includes the radial vanes along the entire height thereof. Typically burning chambers on such fire pit products comprise a glass tube, so that the flame may be readily visible. This type of product requires not a glass tube but rather a plurality of arched glass vanes oriented to impart a spin to the air entering the burning chamber between the vanes. Such a glass structure is distracting, however, and not nearly as uniform as a single glass tube through which the flame may be viewed.

[0008] Therefore, there is a need for a device that provides for interesting flame effects with a gel-type fuel, but with a larger and more interesting flame. The needed device would have no visible air intake vanes for aesthetic simplicity, and would include a single glass or other transparent tube for viewing the flame therein. Such a needed invention would

provide means for reducing the chance of a person getting burned, and would be an attractive device from an aesthetics standpoint. Such a needed device would further be relatively simple to manufacture and use. The present invention accomplishes these objectives.

SUMMARY OF THE INVENTION

[0009] The present device is a burner for consuming a fuel such as bio ethanol ("fuel gel" or "fire gel"), alcohol or ethanol gels, wood or kerosene, and for resting on a horizontal surface such as a table or viewing pedestal. A base has a lower end and an upper end, and at least one side wall. A fuel inlet port of the upper end of the base includes at least an inner wall and a bottom wall, and may be a fuel container having an open top end. Alternately, the fuel inlet port includes an open end of a pressurized fuel conduit, such as for conveying a pressurized fuel such as propane, natural gas or the like.

[0010] At least one helical conduit is fixed outside of the inner wall of the fuel inlet port. Each helical conduit is adapted for conveying air from a first open end thereof at the lower end of the base to a second open end thereof at the upper end of the base. The lower end of the base **30** is adapted to support the burner on the horizontal surface while providing air flow to the first open end of the at least one helical conduit, such as with a plurality of feet around which air may flow, or radial grooves through which air may flow.

[0011] In one embodiment, the at least one helical conduit is contained in an annular air guide sleeve that is adapted to be slidably received in a central aperture of the base. In such an embodiment, the fuel container is adapted to be slidably received within a longitudinal bore of the air guide sleeve. Alternately, the fuel inlet port is integrated into a top end of the air guide sleeve.

[0012] An annular glass burning chamber has a bottom end, a top end, an inner wall and an outer wall. The bottom end of the burning chamber is fixed with the upper end of the base, such that the second end of the at least one conduit terminates therebetween. As such, the fuel in the fuel inlet port mixes with the air entering the burning chamber from the at least one helical conduit and burns in a helical pattern within the burning chamber.

[0013] In one embodiment, an annular transparent cooling sleeve is fixed around the burning chamber with at least one heat-resistant spacing bracket. The cooling sleeve is open at a first bottom end and at a second top end thereof. As such, air heated by the outer wall of the burning chamber rises and exists at a top gap defined between the second top end of the cooling sleeve and the top end of the burning chamber. In this fashion, cooler air is drawn between the cooling sleeve and the burning chamber at an air gap between the first bottom end of the cooling sleeve and the upper end of the base, the air gap resulting from at least one spacing bracket being fixed between the base and the cooling sleeve.

[0014] The second end of the at least one helical conduit preferably terminates between the burning chamber and the fuel inlet port of the base in a direction substantially tangential to and upwardly included with the inner wall of the burning chamber. In this way the fuel is mixed with air to form a smooth helical fire pattern along the inner wall of the burning chamber. However, in an alternate embodiment, the second end of the at least one helical conduit terminates between the burning chamber and the fuel inlet port of the base in a direction somewhere between the longitudinal axis of the burning chamber and the inner wall of the burning chamber,

yet while still being upwardly included with respect to the base. In such an embodiment, the helical fire pattern of the fuel being burned is more centrally located within the burning chamber, closer towards the longitudinal axis of the burning chamber than at the inner wall of the burning chamber.

[0015] The present invention a device that provides for interesting flame effects with a gel-type fuel such as bio ethanol in a can, but with a larger and more interesting flame than a traditional gel fuel burner. The present device has no visible air intake vanes, making it aesthetic simple, and includes a single glass or other transparent tube for viewing the flame therein in a non-distracting manner. The present invention provides means for reducing the chance of a person getting burned, and is aesthetically pleasing to look at, both when in use and when not in use. The present device further is relatively simple to manufacture and use. Other features and advantages of the present invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

DESCRIPTION OF THE DRAWINGS

- [0016]** FIG. 1 is a top perspective view of the invention;
[0017] FIG. 2 is an exploded top perspective view of the invention;
[0018] FIG. 3 is a bottom perspective view of the invention;
[0019] FIG. 4 is a perspective view of a number of different embodiments of the invention;
[0020] FIG. 5 is a top perspective view of a fuel container combined with an annular air guide sleeve of the invention;
[0021] FIG. 6 is a bottom perspective view of the fuel container as engaged with a base of the invention;
[0022] FIG. 7 is a top perspective view of the base of FIG. 6 without the fuel container therein;
[0023] FIG. 8 is a bottom perspective view of FIG. 7; and
[0024] FIG. 9 is an enlarged top perspective view of an upper end of the base.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0025] Illustrative embodiments of the invention are described below. The following explanation provides specific details for a thorough understanding of and enabling description for these embodiments. One skilled in the art will understand that the invention may be practiced without such details. In other instances, well-known structures and functions have not been shown or described in detail to avoid unnecessarily obscuring the description of the embodiments.

[0026] Unless the context clearly requires otherwise, throughout the description and the claims, the words “comprise,” “comprising,” and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of “including, but not limited to.” Words using the singular or plural number also include the plural or singular number respectively. Additionally, the words “herein,” “above,” “below” and words of similar import, when used in this application, shall refer to this application as a whole and not to any particular portions of this application. When the claims use the word “or” in reference to a list of two or more items, that word covers all of the following interpretations of the word: any of the items in the list, all of the items in the list and any combination of the items in the list. When the word “each” is used to refer to an element that

was previously introduced as being at least one in number, the word “each” does not necessarily imply a plurality of the elements, but can also mean a singular element.

[0027] FIGS. 1 and 2 illustrate a burner 10 for consuming a fuel 20, and for resting on a horizontal surface 15 (FIG. 4). A base 30 has a lower end 32 (FIG. 3) and an upper end 38 (FIG. 1), and at least one side wall 35 of a height sufficient for the base 30 to contain a fuel inlet port 40 therein. The base 30 may take the shape of a square in top plan view, a circle, or any other suitable shape.

[0028] The fuel inlet port 40 includes at least an inner wall 46 and a bottom wall 42, and may be preferably as simple as a fuel container 41 having an open top end 48. As such the fuel 20 may be contained within the container 41, such a fuel being a gel-type fuel such as alcohol or ethanol gels, bio ethanol in a can (so-called “fire gel”), wood, kerosene, or the like. Alternately, the fuel inlet port 40 may include an open end of a pressurized fuel conduit 150, such as for conveying a pressurized fuel such as propane, natural gas or the like.

[0029] The base 30 may include a central aperture 70 through at least the upper end 38 thereof, through which the fuel inlet port 40 is retained therein, or in the embodiment having the fuel container 41, through which the fuel container 41 is slidably received. Alternately the fuel inlet port 40 or fuel container 41 is integrally formed in the top side 38 of the base 30.

[0030] At least one helical conduit 50 is fixed outside of the inner wall 46 of the fuel inlet port 50, and preferably the at least one helical conduit 50 includes two, three, four or more of the helical conduits 50. Each helical conduit 50 is adapted for conveying air from a first open end 52 thereof at the lower end 32 of the base 30 to a second open end 58 (FIG. 9) thereof at the upper end 38 of the base 30. The lower end 32 of the base 30 is adapted to support the burner 10 on the horizontal surface while providing air flow to the first open end 52 of the at least one helical conduit 50, such as with a plurality of feet 160 around which air may flow, or radial grooves 170 (FIG. 3) through which air may flow.

[0031] In one embodiment, the at least one helical conduit 50 is contained in an annular air guide sleeve 80 that is adapted to be slidably received in the central aperture 70 of the base. In such an embodiment, the fuel container 41 is adapted to be slidably received within a longitudinal bore 85 of the air guide sleeve 80. Alternately, the fuel inlet port 40 is integrated into a top end 88 of the air guide sleeve 80.

[0032] Preferably the base 30 and the air guide sleeve 80 are mutually rotationally locked together, such as with a bracket and prong 180 mechanism (FIG. 3) that secures the air guide sleeve 80 rotationally with the base 30. Alternately, the air guide sleeve 80 includes a radially-projecting tab 180 that fits within a radially recessed slot 190 (FIGS. 5-8) of the central aperture 70 of the base 30, so that the air guide sleeve 80 and base 30 are keyed together and not allowed to rotate with respect to each other, the at least one helical conduit formed between the air guide sleeve and the central aperture of the base 30. Alternately, the air guide sleeve 80 and the central aperture 70 may be non-circular to prevent mutual rotation thereof when mutually engaged.

[0033] An annular burning chamber 60 has a bottom end 62, a top end 68, an inner wall 66 and an outer wall 64. The bottom end 62 of the burning chamber 60 is fixed with the upper end 38 of the base 30, such that the second end 58 of the at least one conduit 50 terminates therebetween. As such, the fuel 20 in the fuel inlet port 40 mixes with the air entering the

burning chamber 60 from the at least one helical conduit 50 and burns in a relatively tall, helical pattern within the burning chamber 60. Preferably the burning chamber 60 is made from a rigid, transparent, heat-resistant material, such as glass. Alternately, the burning chamber 60 may be made from a rigid translucent material, such as stained or frosted glass.

[0034] In one embodiment, an annular transparent cooling sleeve 90 is fixed around the burning chamber 60 with at least one heat-resistant spacing bracket 100 (FIGS. 1 and 4). The cooling sleeve 90 is open at a first bottom end 92 and at a second top end 98 thereof. As such, air heated by the outer wall 64 of the burning chamber 60 rises and exists at a top gap 110 defined between the second top end 98 of the cooling sleeve 90 and the top end 68 of the burning chamber 60. In this fashion, cooler air is drawn between the cooling sleeve 90 and the burning chamber 60 at an air gap 140 between the first bottom end 92 of the cooling sleeve 90 and the upper end 38 of the base, the air gap 140 resulting from at least one spacing bracket 100 being fixed between the base 30 and the cooling sleeve 90. The cooling sleeve 90 may be made from the same material as the burning chamber 60, or a different material as desired. Preferably, however, the cooling sleeve 90 is rigid and non-opaque. The cooling sleeve 90 is sized to substantially cover the burning chamber 60 to inhibit the touching of the burning chamber 60, which could result in a person being burned. The cooling sleeve 90 is continuously cooled by convection and the flow of air between the cooling sleeve 90 and the burning chamber 60.

[0035] In one embodiment, the base 30 includes an outer circular recess 120 adapted to receive the first bottom end 92 of the cooling sleeve 90 therein. The base 30 may further include an inner circular recess 130 adapted to receive the bottom end 62 of the burning chamber 60. The outer circular recess 120 and the inner circular recess 130 are preferably circular to match the shape of the preferably cylindrical cooling sleeve 90 and the burning chamber 60. However, each could be square in cross-section, triangular in cross-section, or some other shape, it being understood that the inner wall 66 of the burning chamber 60 is preferably cylindrical in shape so as to allow for a smoother helical fire pattern of the fuel 20 being burned.

[0036] The second end 58 of the at least one helical conduit 50 preferably terminates between the burning chamber 60 and the fuel inlet port 40 of the base 30 in a direction substantially tangential to and upwardly included with the inner wall 66 of the burning chamber 60. In this way the fuel 20 is mixed with air to form a smooth helical fire pattern along the inner wall 66 of the burning chamber 60. However, in an alternate embodiment, the second end 58 of the at least one helical conduit 50 terminates between the burning chamber 60 and the fuel inlet port 40 of the base 30 in a direction somewhere between the longitudinal axis of the burning chamber and the inner wall 66 of the burning chamber 60, yet while still being upwardly included with respect to the base 30. In such an embodiment, the helical fire pattern of the fuel 20 being burned is more centrally located within the burning chamber 60, closer towards the longitudinal axis of the burning chamber than at the inner wall 66 of the burning chamber 60.

[0037] While a particular form of the invention has been illustrated and described, it will be apparent that various modifications can be made without departing from the spirit and scope of the invention. For example, four of the helical conduits 50 are illustrated in the drawings. However, any practical number of helical conduits 50 could be used.

Accordingly, it is not intended that the invention be limited, except as by the appended claims.

[0038] Particular terminology used when describing certain features or aspects of the invention should not be taken to imply that the terminology is being redefined herein to be restricted to any specific characteristics, features, or aspects of the invention with which that terminology is associated. In general, the terms used in the following claims should not be construed to limit the invention to the specific embodiments disclosed in the specification, unless the above Detailed Description section explicitly defines such terms. Accordingly, the actual scope of the invention encompasses not only the disclosed embodiments, but also all equivalent ways of practicing or implementing the invention.

[0039] The above detailed description of the embodiments of the invention is not intended to be exhaustive or to limit the invention to the precise form disclosed above or to the particular field of usage mentioned in this disclosure. While specific embodiments of, and examples for, the invention are described above for illustrative purposes, various equivalent modifications are possible within the scope of the invention, as those skilled in the relevant art will recognize. Also, the teachings of the invention provided herein can be applied to other systems, not necessarily the system described above. The elements and acts of the various embodiments described above can be combined to provide further embodiments.

[0040] All of the above patents and applications and other references, including any that may be listed in accompanying filing papers, are incorporated herein by reference. Aspects of the invention can be modified, if necessary, to employ the systems, functions, and concepts of the various references described above to provide yet further embodiments of the invention.

[0041] Changes can be made to the invention in light of the above "Detailed Description." While the above description details certain embodiments of the invention and describes the best mode contemplated, no matter how detailed the above appears in text, the invention can be practiced in many ways. Therefore, implementation details may vary considerably while still being encompassed by the invention disclosed herein. As noted above, particular terminology used when describing certain features or aspects of the invention should not be taken to imply that the terminology is being redefined herein to be restricted to any specific characteristics, features, or aspects of the invention with which that terminology is associated.

[0042] While certain aspects of the invention are presented below in certain claim forms, the inventor contemplates the various aspects of the invention in any number of claim forms. Accordingly, the inventor reserves the right to add additional claims after filing the application to pursue such additional claim forms for other aspects of the invention.

What is claimed is:

1. A burner for consuming a fuel and for resting on a horizontal surface, the burner comprising:
 - a base having a lower end, an upper end, and at least one side wall of a height sufficient for the base to contain a fuel inlet port therein, the fuel inlet port including at least an inner wall and a bottom wall;
 - at least one helical conduit fixed outside of the inner wall of the fuel inlet port and adapted for conveying air from a first open end thereof at the lower end of the base to a second open end thereof at the upper end of the base, the lower end of the base adapted to support the burner on

- the horizontal surface while providing air flow to the first open end of the at least one helical conduit;
- an annular burning chamber having a bottom end, top end, an inner wall and an outer wall, the bottom end of the burning chamber fixed with the upper end of the base, the second end of the at least one conduit terminating between the burning chamber and the fuel inlet port;
- whereby the fuel in the inlet port mixes with the air entering the burning chamber from the at least one helical conduit and burns in a helical pattern within the burning chamber.
2. The burner of claim 1 wherein the fuel inlet port is an open end of a fuel container, the fuel container adapted to contain the fuel therein.
3. The burner of claim 1 wherein the base includes a central aperture through the upper end thereof, the fuel inlet port adapted to be retained therein.
4. The burner of claim 2 wherein the base includes a central aperture through the upper end thereof, the fuel container adapted to be slidably received therein.
5. The burner of claim 1 wherein the base includes a central aperture through the upper end thereof, and wherein the at least one helical conduit is contained in an annular air guide sleeve adapted to be slidably received therein, the fuel inlet port integrated in a top end of the air guide sleeve.
6. The burner of claim 2 wherein the base includes a central aperture through the upper end thereof, and wherein the at least one helical conduit is contained in an annular air guide sleeve adapted to be slidably received therein, the fuel container adapted to be slidably received within a longitudinal bore of the air guide sleeve.
7. The burner of claim 5 wherein the base and the air guide sleeve are mutually rotationally locked, whereby the air guide sleeve is prevented from spinning within the central aperture of the base.
8. The burner of claim 6 wherein the base and the air guide sleeve are mutually rotationally locked, whereby the air guide sleeve is prevented from spinning within the central aperture of the base.
9. The burner of claim 1 wherein the annular burning chamber is transparent.
10. The burner of claim 9 wherein the annular burning chamber further includes an annular transparent cooling sleeve fixed therearound with at least one spacing bracket, the

cooling sleeve open at a first bottom end and a second top end thereof, whereby air heated by the burning chamber rises and exits at a top gap defined between the second top end of the cooling sleeve and the top end of the burning chamber, thereby drawing cooler air therebetween from the first bottom end of the cooling sleeve, the cooling sleeve sized to inhibit touching of the burning chamber.

11. The burner of claim 10 wherein the upper end of the base includes an outer circular recess adapted to receive the first bottom end of the cooling sleeve and an inner circular recess adapted to receive the bottom end of the burning chamber, the at least one spacing bracket fixed about the first bottom end of the cooling sleeve providing an air gap thereunder through which air may flow between the cooling sleeve and the burning chamber.

12. The burner of claim 1 wherein the at least one helical conduit includes exactly two opposing helical conduits in a double-helix pattern.

13. The burner of claim 1 wherein the at least one helical conduit includes exactly three evenly-spaced helical conduits in a triple-helix pattern.

14. The burner of claim 1 wherein the at least one helical conduit includes exactly four evenly-spaced helical conduits in a quadruple-helix pattern.

15. The burner of claim 1 wherein the second end of the at least one conduit terminates between the burning chamber and the fuel inlet port in a direction substantially tangential to and upwardly inclined with the inner wall of the burning chamber.

16. The burner of claim 1 wherein the second end of the at least one conduit terminates between the burning chamber and the fuel inlet port in a direction between the longitudinal axis and the inner wall of the burning chamber, and upwardly inclined with respect to the base.

17. The burner of claim 1 wherein the fuel inlet port is the open end of a pressurized fuel conduit.

18. The burner of claim 1 wherein the base includes a plurality of feet for supporting the base above the horizontal surface, around which air flows to the first end of the at least one conduit.

19. The burner of claim 1 wherein the base includes a plurality of radial grooves for conducting air to the first end of the at least one conduit.

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