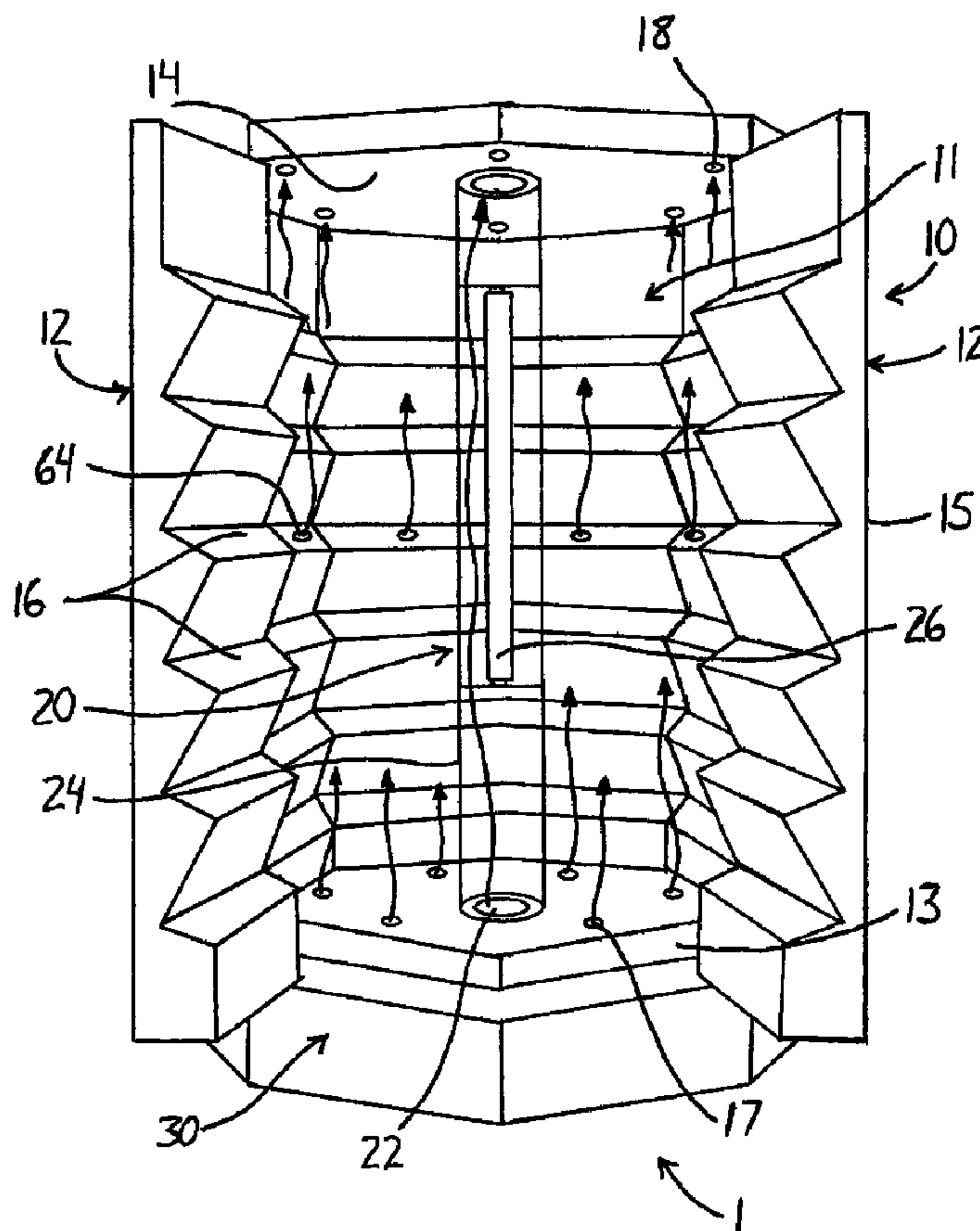




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(57) **Abrégé/Abstract:**

A plant growth chamber has a housing having an interior and shelves for holding plants; a humidity chamber for injecting humidity into incoming air; vents directing the humidified air into the interior of the housing; and a light system within the housing. The light system is a light in an enclosed tube, and the enclosed tube has a separate air system for dissipating heat generated by the light.

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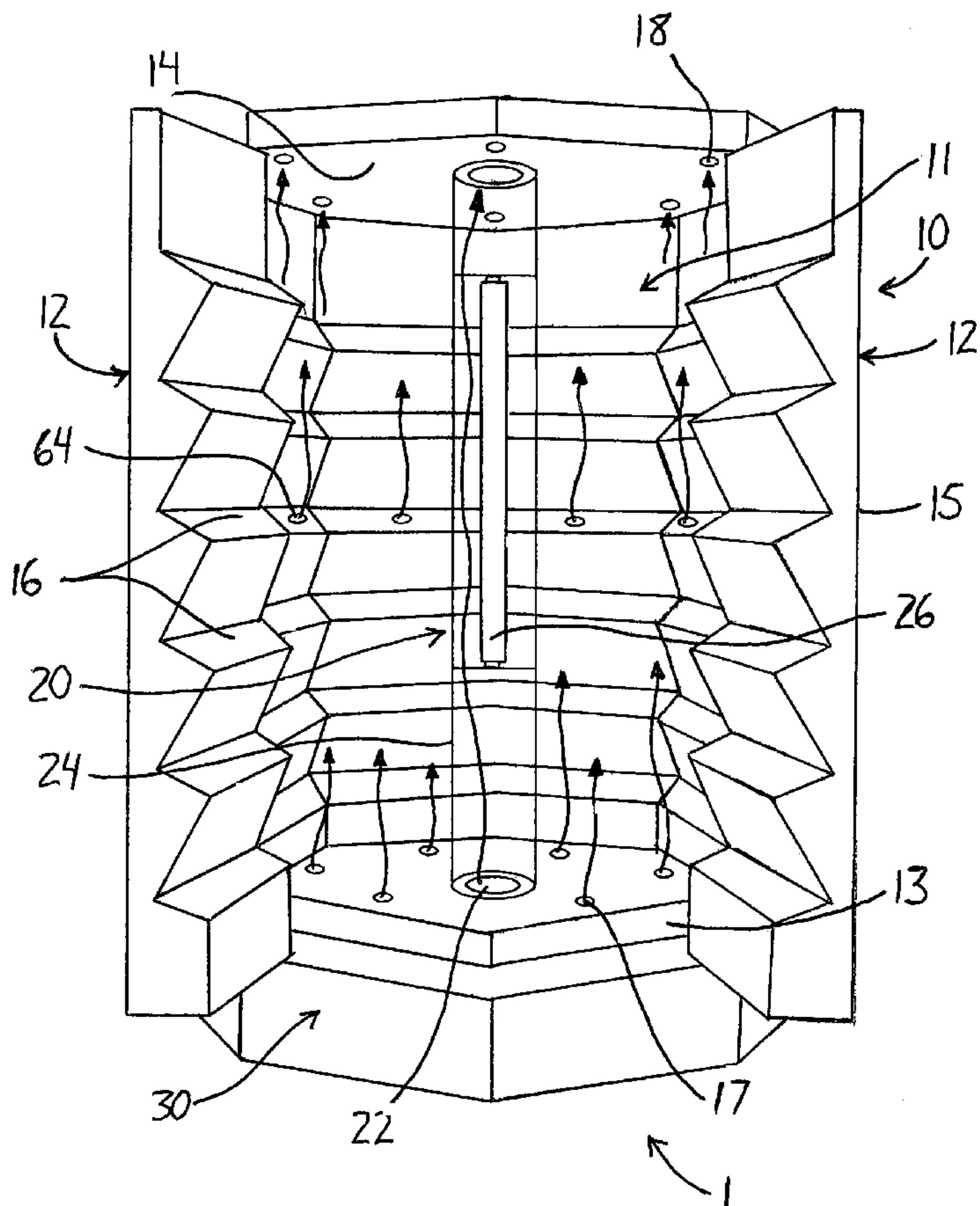
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

GROWTH CHAMBER

PRIOR APPLICATION INFORMATION

This application claims the benefit of United States Provisional Patent Application 60/588,321, filed July 16, 2004.

5

FIELD OF THE INVENTION

The invention relates generally to the field of agriculture. More specifically, the present invention relates to a sealed growth chamber for growing plants therein.

10

BACKGROUND OF THE INVENTION

Typically, plants such as bedding plants and the like are grown in specialized greenhouses wherein humidity and temperature are carefully controlled. Individuals often attempt to recreate greenhouse conditions in their own homes, for example, by having a dedicated room for plant growing wherein humidity and temperature are controlled. However, it can be expensive to regulate the temperature of a large area and excess humidity can damage the structural integrity of the surrounding area.

15

Clearly, a plant growth chamber is needed which allows temperature and humidity within the chamber to be regulated.

20

SUMMARY OF THE INVENTION

According to a first aspect of the invention, there is provided a plant growth chamber comprising:

25

a housing having an interior and a plurality of shelves for holding

- 2 -

plants;

a humidity chamber for injecting humidity into incoming air;
vents directing the humidified air into the interior of the housing; and
a light system within the housing, said light system comprising a light in
5 an enclosed tube, said enclosed tube having a separate air system for dissipating
heat generated by the light.

According to another aspect of the invention, there is provided a plant growth
chamber comprising:

10 a housing having an interior, a base, a top, sidewalls and a door for accessing
the interior of the housing;

said base having entry air holes;

said sidewalls having a plurality of shelves extending outwardly therefrom for
holding plants therein;

15 a humidity chamber arranged to draw outside air via a duct, said humidity
chamber having a plurality of misters for injecting water into said outside air, thereby
producing humidified air;

said humidity chamber being connected to the entry air holes via a duct for
passing said humidified air into the interior of the growth chamber; and

20 a light system comprising a light in an enclosed tube within the interior of the
housing, said tube extending from the base of the housing to the top of the housing,
said enclosed tube having a separate air system for dissipating heat generated by the
light, wherein heated air exits the housing through the top of the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

25 Figure 1 is a side view of the growth chamber with the doors open.

Figure 2 shows the base of the growth chamber and the humidifier air
feed and the light system air feed.

Figure 3 shows the base of the interior and the entry air holes of the
growth chamber.

30 Figure 4 shows the top of the interior and the exit air holes.

- 2a -

Figure 5 is a rear view of the growth chamber which shows the feeder lines.

Figure 6 is a rear view of the growth chamber which shows the upper ducts.

5

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the invention belongs. Although any methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, the preferred methods and materials are now described. All

10

publications mentioned hereunder are incorporated herein by reference.

Referring to the drawings, a growth chamber 1 comprises a housing 10, a light system 20, a nutrient reservoir 30, a humidity chamber 40, a duct system 50 and a temperature equilibration system 60.

5 In the embodiment shown in Figure 1, the housing 10 has a substantially octagonal shape. As will be appreciated by one of skill in the art, this arrangement provides additional growth area for the plants as discussed below; however, it is to be understood that other suitable shapes for example, square, rectangular, triangular, hexagonal, pentagonal, heptagonal, nonagonal and the like
10 may be used and are within the scope of the invention.

 The housing 10 includes an interior 11, at least one door 12, a base 13, a top 14, side walls 15, a plurality of shelves 16, entry air holes 17, exit air holes 18 and removable exterior panels 19. In a preferred embodiment, the door 12 comprises one or more side walls 15 which is arranged to pivot from an open
15 position to a closed position. That is, in some embodiments, the door 12 is in effect a pivoting side wall 15. It is also of note that as discussed herein, in some embodiments, the housing 10 is arranged so as to be sealed or enclosed, that is, substantially air-tight such that air within the interior 11 of the housing 10 does not
20 exit to the surrounding environment when the door 12 is closed. The door 12 can be opened to access the interior 11 of the growth chamber 1. The plurality of shelves 16 are arranged for storing the plants therein, as discussed below. As can be seen in Figure 1, in some embodiments, the shelves 16 extend outwardly from the side walls 15 of the housing 10 at an angle, as discussed below. The entry air holes 17 in the base 13 accept air from the humidity chamber 40 and direct the
25 humidified air into the interior 11 of the housing 10 as discussed below. The exit air

holes 18 at the top 14 allow air to exit the interior 11 of the housing 10 to the duct system 50, as discussed below. The removable exterior panels 19 provide access to the backs of the shelves 16, that is, access to the roots of the plants, as discussed below. In addition, the removable exterior panels 19 also provide easy
5 access to the shelves 16 for cleaning.

In the embodiment shown in Figure 1, the light system 20 comprises an air intake 22 and a tube 24 connected to the air intake 22, the tube 24 being in the interior 11 of the housing 10 and containing one or more lights 26. As discussed below, air is taken in at the air intake 22 and is passed into the interior
10 11 of the housing 10 through the tube 24. As discussed herein, the tube 24 is sealed and extends from the base 13 of the housing 10 to the top 14 of the housing 10. As discussed below, the air is passed over the lights 26, thereby heating the air, before exiting at the top 14 of the housing 10 into the duct system 50. As a result of this arrangement, the plants in the growth chamber 1 are not
15 directly exposed to air heated by the lights 26, as discussed below. Furthermore, this arrangement provides a quantity of dry heated air that can be used for other purposes, for example, heating the surrounding area or heating incoming air. Thus, the growth chamber 1 has two completely separate air systems: a first air system within the interior 11 of the growth chamber 1 and a second air system within the
20 light system 20. This arrangement provides greater temperature management, as discussed below.

As will be appreciated by one of skill in the art, there are many suitable arrangements for the lights 26 which can be used within the invention provided of course that plants at a given position within the growth chamber 1 are
25 exposed to the desired amount of light. For example, the lights 26 may be a single

light that extends along the entire length of the tube 24 or a single light that extends along substantially the entire length of the tube 24. In other embodiments, multiple lights may be used in substantially equivalent positions as the single light arrangement discussed above. In yet other embodiments, the lights 26 may be a
5 single light, for example, an eight inch light within an 8 inch sleeve that is further inserted into a 10 inch sleeve. In this arrangement, the light does not extend along the entire length of the tube 24 but may be approximately 6 inches from the top 14 of the housing 10 and approximately 3 inches from the base 13 of the housing 10. As will be appreciated by one of skill in the art, this will of course depend on the
10 dimensions of the growth chamber which as discussed above may be varied within the invention. In other embodiments, the eight inch sleeve may be an inch and a half from the top and bottom. It is of note that this arrangement provides two additional layers of plastic which further dissipates the heat from the lights 26.

Thus, as discussed above, there are several possible light sources
15 and arrangements that may be used within the invention and the exact arrangement of the light system 20. For example, fluorescent lights, either magnetic ballast or electronic ballast could be used. In these embodiments, the lights 26 may not be inserted in sleeves as discussed above. However, it is of note that in preferred embodiments the lights 26 are metal halide or high pressure
20 sodium. Furthermore, in these embodiments, multiple bulbs may be used instead of a single cylindrical bulb as discussed above.

The nutrient reservoir 30 stores a quantity of nutrients that is fed to the plants, as discussed below. It is of note that any suitable combination of nutrients and water known in the art may be stored in the nutrient reservoir 30. The
25 nutrient reservoir 30 comprises a pump connected to a plurality of feeder lines 32

which are inserted into the growth media of the respective plants, as discussed below. It is also of note that in some embodiments, the nutrient reservoir 30 is blacked out or otherwise made substantially light-impermeable such that light for example light from the light system 20 does not enter the nutrient reservoir. As a result of this arrangement, algae growth within the nutrient reservoir 20 is minimized as is the breakdown of photo-labile nutrients.

The humidity chamber 40 comprises a plurality of misters 42. Specifically, air is brought in from the outside via the duct system 50, described below. Once in the humidity chamber 40, the misters 42 may inject water into the air, thereby humidifying the air prior to passing the humidified air into the interior 11 of the housing 10 via the entry air holes 17, as discussed below. Specifically, by varying the number of misters activated, the humidity injected into the air can be controlled, thereby regulating the humidity of the air. It is of note that as a result of this arrangement, the humidity of the air can be increased to 100%, if so desired. For example, this may be accomplished by activating all of the misters while lower humidity levels may be accomplished by activating fewer misters. As will be appreciated by one of skill in the art, the actual number of misters and the amount of water generated by each mister in response to activation may be varied and these arrangements are within the scope of the invention. It is of note that the humidity chamber may include a water reservoir for providing water to the misters and/or the misters may be fed water via a water line. It is noted that such misters are known in the art as are a variety of means for determining the humidity of air.

The duct system 50 comprises a humidifier air feed 52, a light system air feed 54, a light system air duct 56, and a plant air collector 58. As discussed below, the humidifier air feed 52 passes incoming air into the humidity chamber 40

and through the misters 42 and into the interior 11 of the growth chamber 1 via the entry air holes 17. The light system air duct 56 passes air to the sealed tube 24 wherein air is heated by the lights 26 before exiting the tube 24 via the light system air duct 56. The plant air collector 58 collects air exiting the interior 11 of the growth chamber 1 via the exit air holes 18. In some embodiments, this air is passed to a filter system wherein bacteria, dust, odors, humidity and the like are removed from the air.

The temperature equilibration system 60 comprises a plurality of hoses 62 each connecting the humidity chamber 40 to a respective upper opening 64 in the side walls 15 of the housing 10, as shown in Figure 1. The temperature equilibration system 60 is arranged to be turned on or off. When in the on position, humidified air is passed from the humidity chamber 40 directly to the upper portion of the housing 10. As a result of this arrangement, the temperature within the interior 11 of the housing 10 can be maintained at a relatively uniform temperature. However, when the temperature equilibration system is off, air is not passed directly from the humidity chamber 40 to the upper portion of the housing 10. In this arrangement, a temperature gradient forms wherein it is hotter at the top 14 of the housing 10 than the base 13 of the housing 10. Thus, it is possible to vary the temperature between the top 14 of the housing 10 and the base 13 of the housing 10 by as much as 10-20^oF, thereby allowing plants having different growth requirements to grow within the same chamber.

For use, the plant growth chamber 1 is assembled and/or positioned in the desired location. Next, the humidifier air feed 52 and the light system air feed 54 of the duct system 50 are connected to an air source and the misters 42 are connected to a water source. Plants are placed in the shelves 16. Specifically, the

plants may be placed in the shelves 16 by opening the door 12 to the interior 11 of the growth chamber 1. Next, the respective feeder lines 32 are inserted into the growth medium of the respective plants such that each plant is fed by a feeder line 32 connected to the nutrient reservoir 30. It is of note that the feeder lines 32 may
5 be inserted either from the interior 11 of the growth chamber 1 or via the removable exterior panels 19. In some embodiments, for example as shown in Figure 5, the exterior panels 19 may include holes 70 for passing the feeder lines 32 therethrough. The temperature equilibration system 60 is then connected by attaching the hoses 62 to the upper openings 64 and the humidity chamber 40, as
10 discussed above.

In a preferred embodiment, the nutrient reservoir includes a pump which draws nutrients from the nutrient reservoir into a main line which is in turn connected to the feeder lines 32 for supplying nutrients to the plants within the chamber as discussed above.

15 In use, the desired humidity is selected and the appropriate number of misters 42 are activated. Thus, as air travels into the humidity chamber 40, a mist of water is injected into the air by the misters 42, thereby humidifying the air which is then passed into the interior 11 of the growth chamber 1 by the entry air holes 17 and the temperature equilibration system 60, if turned on. The humidified
20 air then passes up the interior 11 of the chamber 1 to the plant air collector 58 at the top 14 of the housing 10. The airflow within the growth chamber 1 is illustrated by the arrows shown in Figure 1. Specifically, as can be seen in Figure 1, air enters at the bottom of the chamber (and may enter through the upper openings if the temperature equilibration system is on) and flows upwardly to the top of the
25 chamber, as discussed below.

As discussed above, if the temperature equilibration system 60 is on, air from the humidity chamber 40 will enter the interior 11 of the housing via upper openings 64, thereby maintaining a generally even temperature within the housing 10.

5 As discussed above, the lights 26 are enclosed in the sealed tube 24 which has a separate air supply system, as discussed below. As discussed above, controlling the air flow, that is, the rate of air passing over the lights 26, is one method used to regulate the temperature within the interior 11 of the growth chamber 1. That is, increasing the air flow over the lights 26 will dissipate heat and
10 lower the temperature while decreasing the air flow will increase the temperature within the interior 11 of the growth chamber 1. Alternatively, air flow within the interior 11 of the growth chamber 1 may be increased to cool the interior 11 of the growth chamber 1.

As discussed above, the plants in the shelves 16 can be accessed by
15 removing the removable exterior panels 19. As a result of this arrangement, all plants and their roots can be accessed at any time with minimal disruption to the surrounding plants.

Because the plant growth chamber 1 is a sealed unit, the temperature and the humidity therewithin can be varied while having minimal
20 impact on the surrounding environment or area. Furthermore, the growth chamber 1 is arranged to maximize the available growing area through the use of the shelves 16 and the light system 20 which extends from the base 13 of the housing 10 to the top 14 of the housing 10, thereby supplying substantially equal amounts of light to all of the plants in the growth chamber.

25 As will be appreciated by one of skill in the art, the depth, height,

location and angle of the shelves 16 can be varied according to user preference. As a result of this arrangement, the growth chamber 1 is flexible enough that a variety of plants can be grown in a single growth chamber. In a preferred embodiment, the shelves 16 are at 23^o, although as discussed above, other
5 suitable angles may also be used and are within the scope of the invention. It is of note that other suitable angles include but are by no means limited to 15-30 degrees and 20-25 degrees. It is of note having the plants at an angle places the top of the plant closest to the lights 26 which has many advantages, including speeding the set time for the plants.

10 As discussed above, in the embodiment shown in the attached figures, the growth chamber 1 has 8 walls with up to 6 shelves per wall. It is of note that this arrangement provides approximately 90 square feet of growing area. As discussed above, other suitable geometries and sizes may also be used which may accommodate more or fewer walls as well as more or fewer shelves.

15 Plants which may be grown in the growth chamber 1 include but are by no means limited to lettuce, kale, chard, collards, arugula, peppers, tomatoes, cucumbers, melons, strawberries, sprouts, herbs, for example, basil, oregano, thyme, sage, parsley and the like, chives, and various flowers.

In other embodiments, one or more of the sidewalls may be arranged for
20 easy removal from the housing such that the sidewall can be placed outside if so desired. In these embodiments, it is of note that the sidewall may be arranged to be a separate enclosed unit, for example, having separate feeder lines as well as possibly a separate nutrient reservoir connected to the sidewall. As a result of this arrangement, the sidewall can be removed from the housing and transported to
25 another location without disconnecting the feeder lines. Furthermore, the sidewall

is arranged to be inserted back into the housing when done.

In an alternative embodiment, the invention comprises a stand-alone unit comprising one sidewall with shelves for storing plants and a plurality of feeder lines connected to a reservoir for feeding the plants. In this arrangement, the
5 sidewall can be placed in any suitable location, either indoors or outdoors, and plants can be placed in the shelves. The feeder lines connected to the reservoir are then inserted into a respective one of the plants such that all of the plants are fed by the reservoir, as is the case with the growth chamber 1 discussed above. In this arrangement, the sidewall may be moved to different locations with a minimum
10 of disruption to the plants.

The invention will now be explained by way of example; however, the invention is not limited by the example which is intended for illustrative purposes only.

In one example, lettuce plants are placed on the bottom shelves of the
15 growth chamber 1 while tomatoes and/or herbs are placed in the middle shelves and peppers and/or melons are placed on the top shelves. The growth chamber 1 may then be arranged such that the bottom shelves are subjected to a temperature of 60-65 degrees, while the middle shelves are subjected to a temperature of approximately 75 degrees and the top shelves are subjected to a temperature of
20 approximately 90 degrees. As discussed above, in this embodiment, the temperature equilibration system 60 is turned off such that the temperature in the upper portion of the growth chamber 1 is greater than the temperature in the lower portion, as discussed above.

In another example, each panel or wall of the growth chamber 1 holds
25 plants of a specific variety and the temperature of the growth chamber is uniform

throughout. It is of note that as discussed above in these embodiments, the temperature equilibration system 60 is on, meaning that the temperature is kept uniform.

While the preferred embodiments of the invention have been described
5 above, it will be recognized and understood that various modifications may be made therein, and the appended claims are intended to cover all such modifications which may fall within the spirit and scope of the invention.

CLAIMS

1. A plant growth chamber comprising:
 - a housing having an interior, a base, a top, sidewalls and a door for accessing the interior of the housing;
 - 5 said base having entry air holes;
 - said sidewalls having a plurality of shelves extending outwardly therefrom for holding plants therein;
 - a humidity chamber arranged to draw outside air via a duct, said humidity chamber having a plurality of misters for injecting water into said outside air, thereby
 - 10 producing humidified air;
 - said humidity chamber being connected to the entry air holes via a duct for passing said humidified air into the interior of the growth chamber; and
 - a light system comprising a light in an enclosed tube within the interior of the housing, said tube extending from the base of the housing to the top of the housing,
 - 15 said enclosed tube having a separate air system for dissipating heat generated by the light, wherein heated air exits the housing through the top of the housing.
2. The plant growth chamber according to claim 1 including a temperature equilibration system comprising a plurality of tubes connected to the humidity chamber for delivering air to an upper portion of the interior of the housing.
- 20 3. The plant growth chamber according to claim 1 including removable panels on an exterior of the sidewalls for accessing the shelves.
4. The plant growth chamber according to claim 1 including a nutrient reservoir.
5. The plant growth chamber according to claim 4 wherein the
- 25 nutrient reservoir is made to be light-impermeable.
6. The plant growth chamber according to claim 4 including a plurality of feeding lines for connecting a respective one of the plants held in the shelves to the nutrient reservoir.
7. The plant growth chamber according to claim 1 wherein the light
- 30 system comprises a single light that extends along the length of the tube.

8. The plant growth chamber according to claim 6 wherein the light is enclosed in at least one plastic sleeve.

9. The plant growth chamber according to claim 1 wherein the shelves are at an angle between 15-30 degrees.

5 10. The plant growth chamber according to claim 1 wherein the shelves are at an angle between 20-25 degrees.

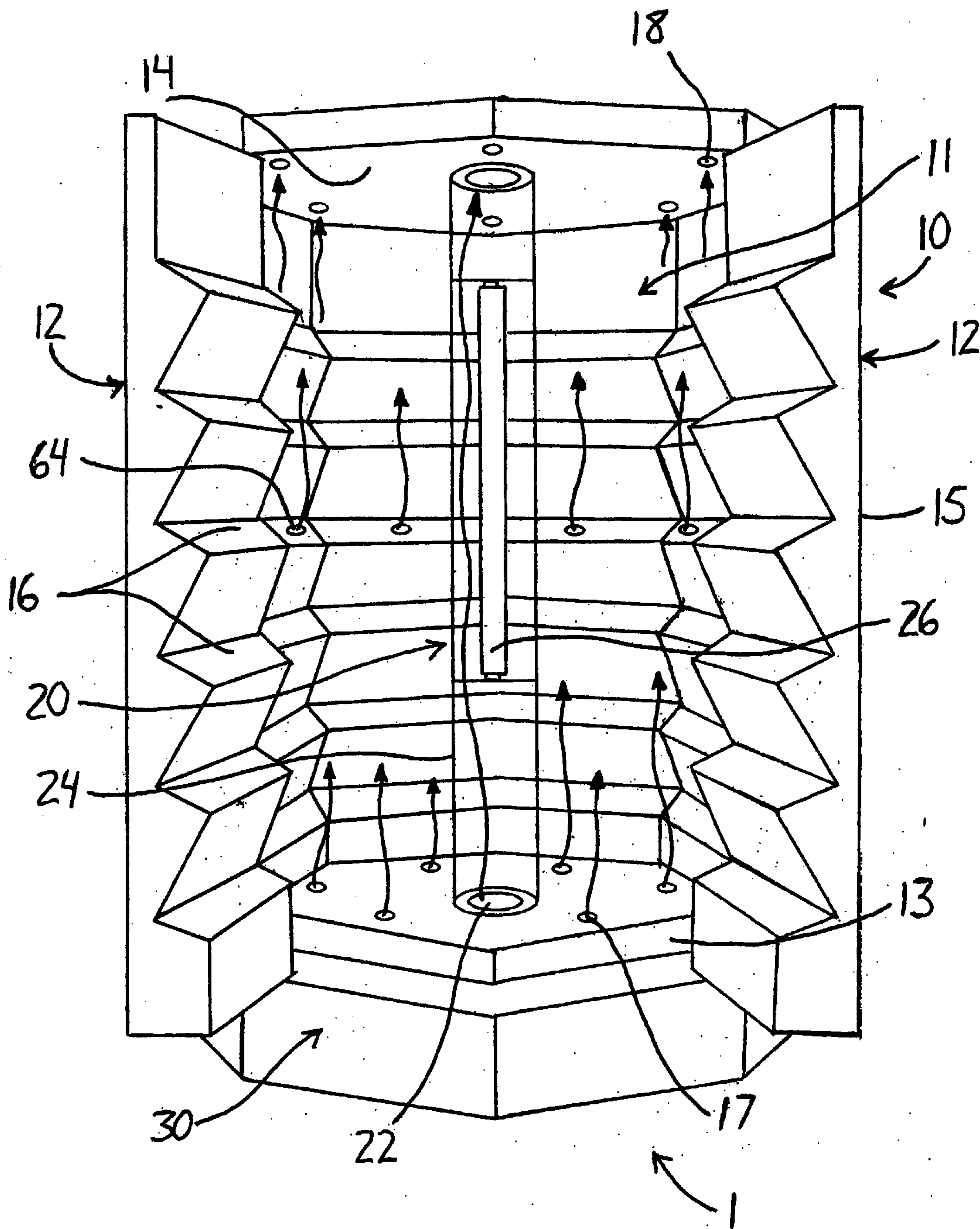


FIG. 1

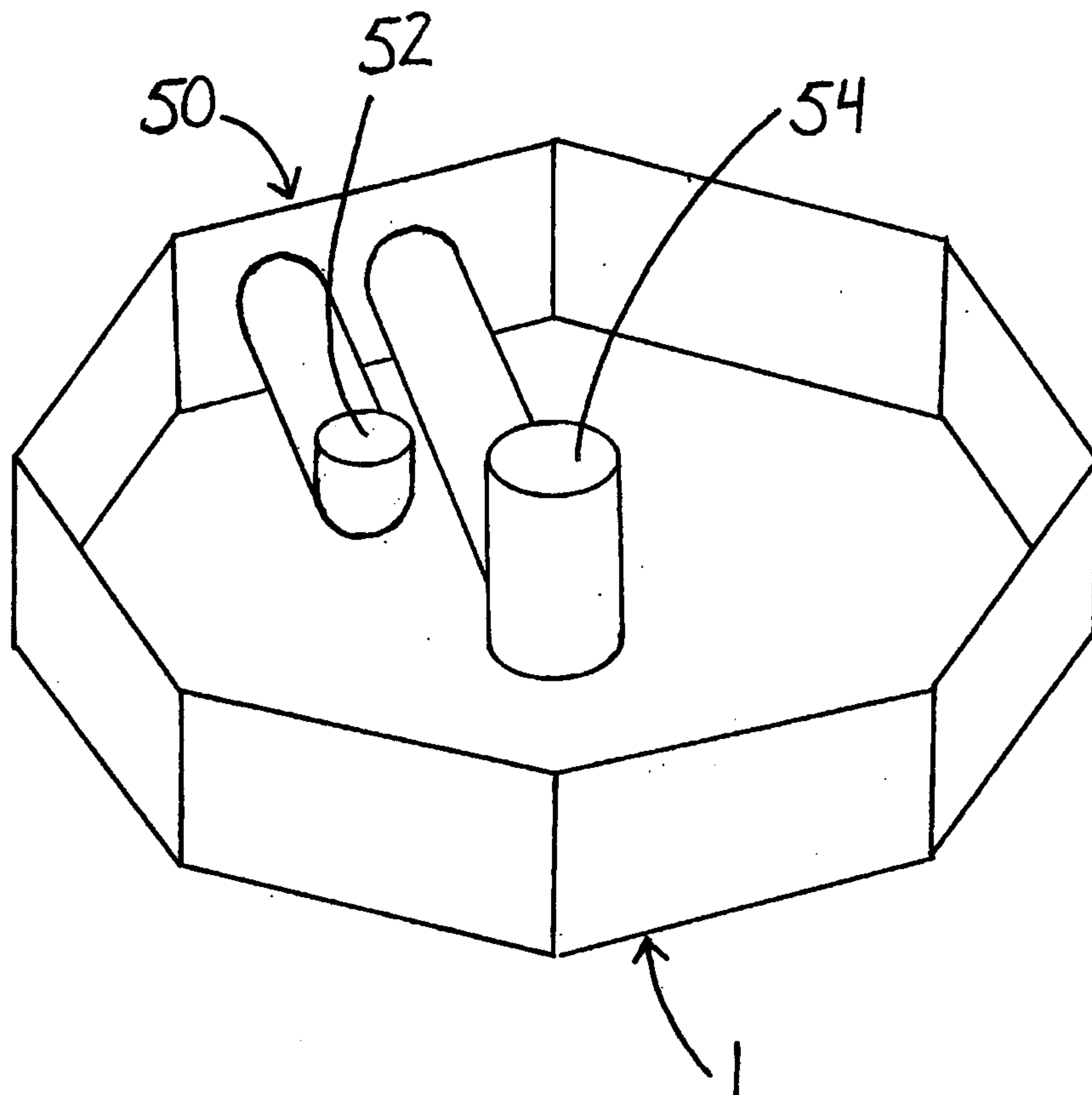


FIG. 2

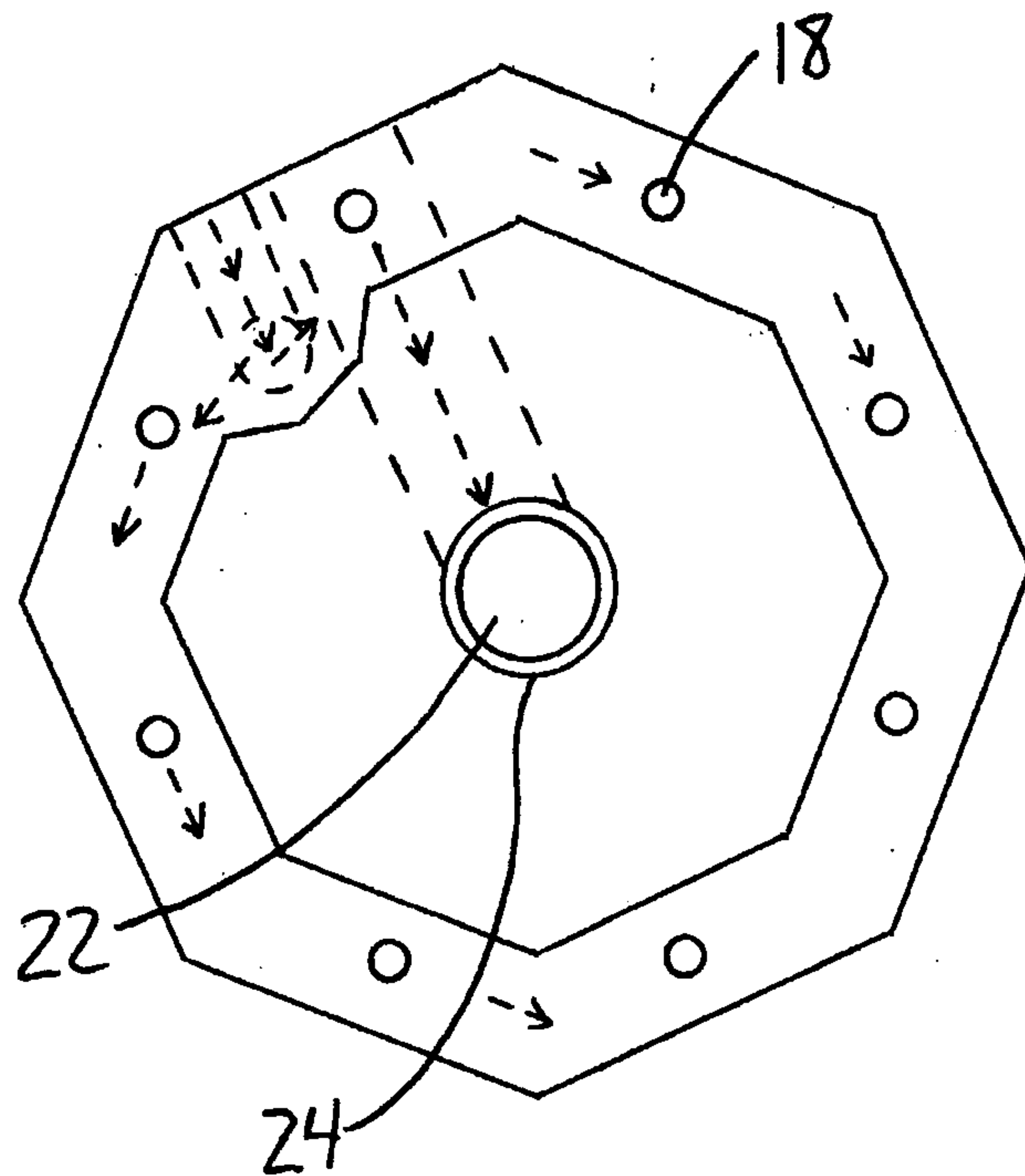


FIG. 3

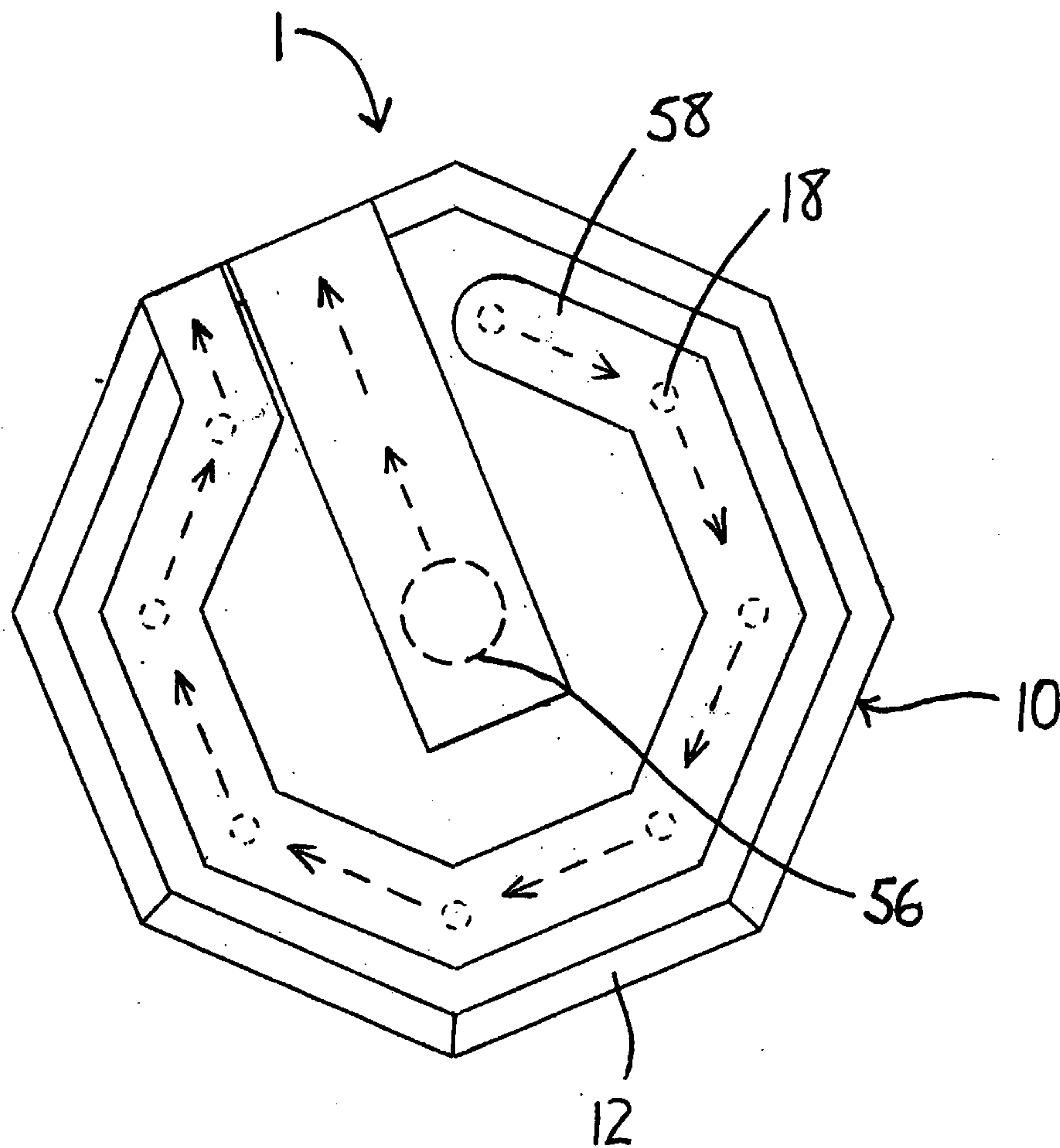


FIG. 4

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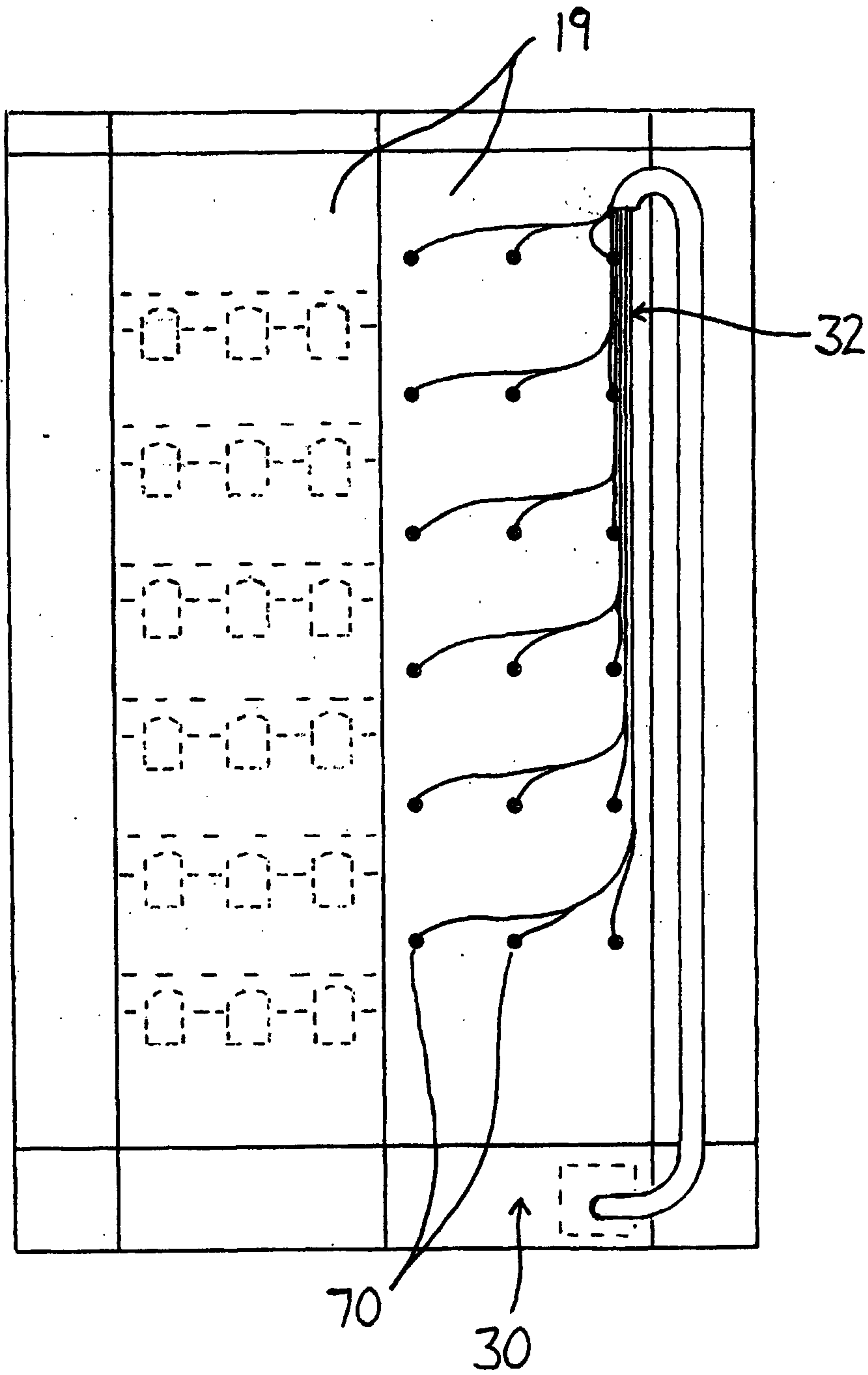


FIG. 5

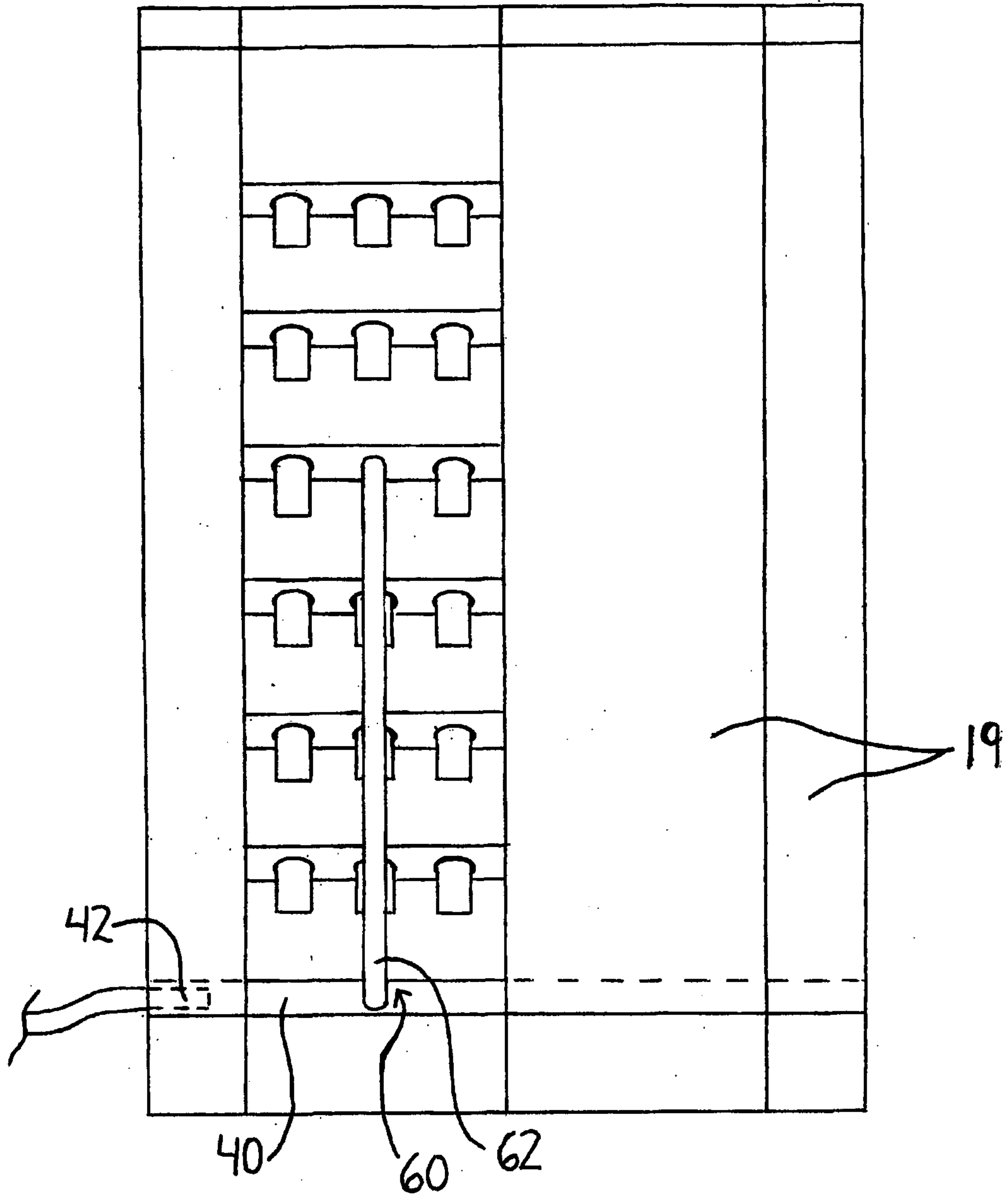


FIG. 6

