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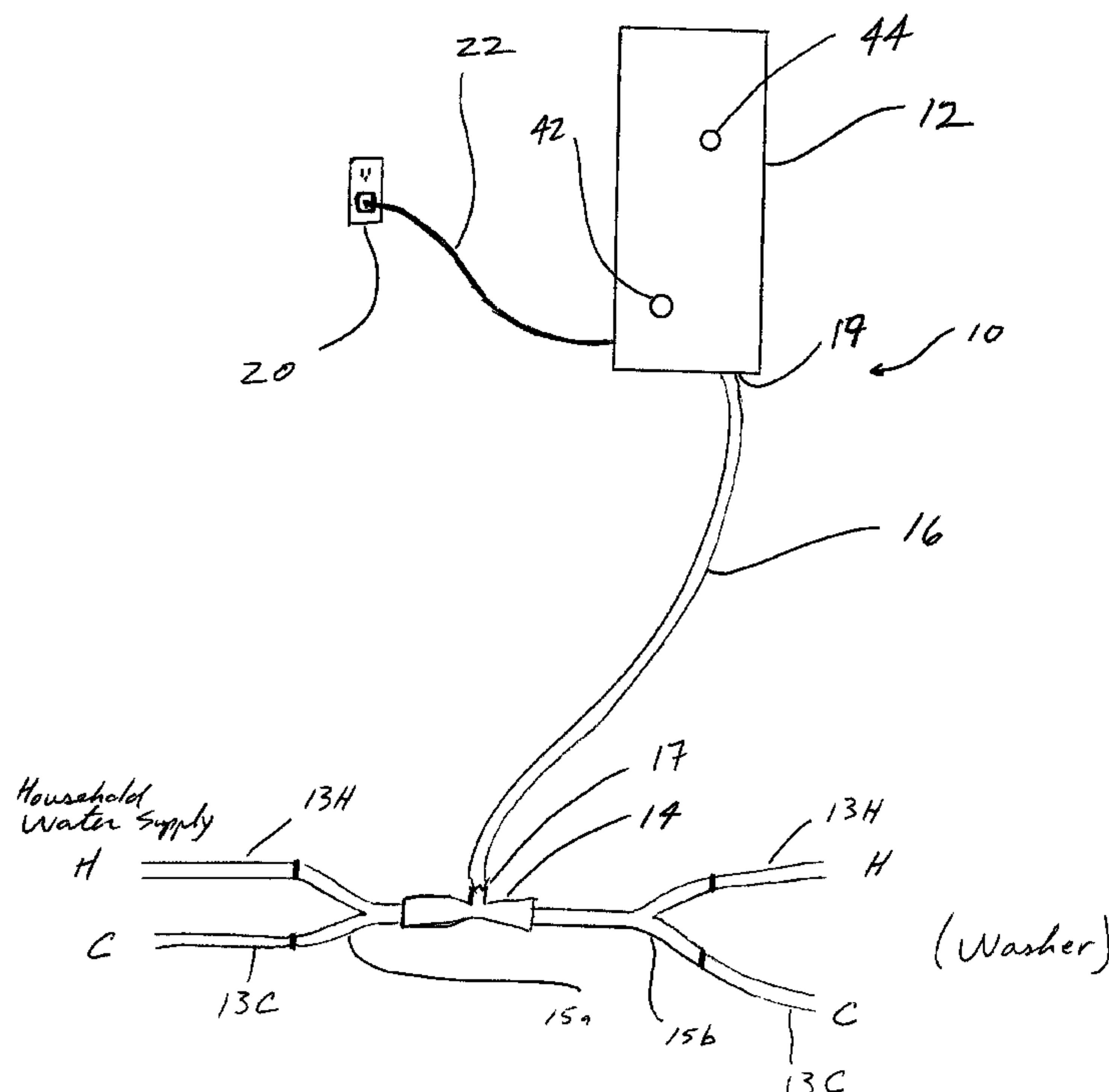
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(54) Title: SMALL-SCALE LAUNDRY OZONATION SYSTEM



(57) Abrégé/Abstract:

A small-scale ozonation system for use in laundry systems such as that found in the home has an ozone generator and a venturi-type differential pressure injector for injecting ozone created by the ozone generator into the water passing between a water supply, through the injector, and on to a washing machine. The ozone generator is turned on and off by the action of a pressure differential switch sensitive to the vacuum created by the flow of water through the injector, thereby creating ozone only when water is filling the washing machine.



Abstract of the Disclosure

A small-scale ozonation system for use in laundry systems such as that found in the home has an ozone generator and a venturi-type differential pressure injector for injecting ozone created by the ozone
5 generator into the water passing between a water supply, through the injector, and on to a washing machine. The ozone generator is turned on and off by the action of a pressure differential switch sensitive to the vacuum created by the flow of water through the injector, thereby creating ozone only when water is filling the washing machine.

SMALL-SCALE LAUNDRY OZONATION SYSTEM

Technical Field

The present invention relates to laundry systems and more particularly to a system for ozonating the water used in a small-scale laundry system such as that found in a typical home.

Background

Ozone has long been known as a disinfectant and sterilant, and is known for its other cleaning properties. Indeed, commercial and industrial ozonated laundry systems, wherein wash water is enriched with ozone in a variety of ways, have been in place for ten years or longer.

Ozone is particularly useful in reducing laundry costs because it is effective at cold temperatures, allowing a user to wash with less hot water, and allowing a user to reduce the amount of detergent used.

Ozonated laundry systems have primarily been applied only on a commercial basis to this point in time, for a number of reasons. Chief among them is the fact that typical ozone-generation systems are quite complicated, and hence, expensive to produce and maintain.

The generation of ozone also requires a good deal of energy. Accordingly, such systems are only used where water-heating and detergent cost savings make them economically worthwhile. Typically, this will only be the case for larger-scale laundry systems which run full-time. Such systems may be employed, for example, in hotels, hospitals, nursing

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homes, and prisons. It is not economically feasible to simply downsize a typical commercial system for use in the home, where laundry is not done constantly.

5 Another principal reason that current commercial systems cannot be employed in the home is that ozone in large commercial ozonated laundry systems is typically produced by a corona discharge. A corona discharge ozone-producing system would be potentially very dangerous if employed in a home laundry system. While lint is carefully
10 controlled in a commercial laundry, in a typical home it is not. Free lint adheres to most surfaces, and a homeowner is much less likely to properly clean and service his appliances than a commercial laundry. This lint can act as a fuel source for a high-current electrical arc such as that produced by a corona discharge, and would be a significant fire hazard.

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 There remains, accordingly, a need for an ozonation system usable with a small-scale laundry system such as that found in a typical home. Preferably, that system would have the following characteristics:

- 20 1. the system would have the ability to produce an effective amount of ozone at an appropriate time during the wash cycle, with no intervention by the user;
2. the system would produce ozone safely without using a corona discharge;
- 25 3. the system would produce ozone only when needed;

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4. the system would be easy to install and service; and
5. the system would be inexpensive.

Summary of Invention

5 The present invention is an ozonation system for a small- scale laundry system such as that found in a typical home. The invention comprises a power supply; an ozone generator comprising a housing containing a lamp for producing ultraviolet light; and a pressure differential switch wired between an external power supply and the UV lamp. The
10 switch is sensitive to the pressure differential between the ambient air and the gas contained within the housing. When the switch is closed, ozone is generated by the UV lamp. The ozone produced by the ozone generator is injected into the water flowing from the household water supply into the washing machine.

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In a preferred embodiment, the ozone is injected by means of a venturi-type differential pressure injector interposed between the water supply and the washing machine.

20 Brief Description of Drawings

In the accompanying figures which illustrate a preferred embodiment of the invention described herein, but which should not be construed as restricting the spirit or scope of the invention in any way:

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Figure 1 is a largely-schematic view of the laundry ozonation

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system of the preferred embodiment of the present invention.

Figure 2 is a largely-schematic view of the interior of the ozone generator of the laundry ozonation system of Figure 1.

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Figure 3 is an end view of the ozone generator shown in Figure 2.

Description

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In a typical small-scale laundry system, such as that which may be found in a home, water is drawn into a washing machine as required through hoses connecting the washing machine to the household hot and cold water supply. Typically, one hose is connected between the hot water supply and a first fitting on the washing machine, and another
15 hose is connected between the cold water supply and a second fitting on the washing machine.

Referring to Figure 1, the laundry ozonation system of the present invention, denoted generally herein by the numeral 10, injects
20 ozone generated by an ozone generator 12 into the water passing through hoses 13H and 13C which connect the household water supply to the washing machine.

25 Ozonation system 10 comprises generally an ozone generator

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12, powered by a power supply 20, most conveniently the household 120V power supply. Ozone is created within generator 12, as described below, when the generator is turned "on".

5 Interposed between the household water supply and the washing machine is a venturi-type differential pressure injector 14. As further described below, it has been found that a suitable injector for the particular embodiment described herein is the Model 384 injector sold by the Mazzei Injector Corporation, of Bakersfield, California. Such an
10 injector has been determined to produce a vacuum range of between about 10" H₂O and 18" H₂O at inlet water pressures of between 50 and 90 psi (the range found in most homes).

Injector 14 has an inlet end and an outlet end, and an inter-
15 mediate inlet port 17. It will be known to those familiar with such injectors that when fluid passes through injector 14 from the inlet end to the outlet end, a vacuum is created at inlet port 17. If a gas is supplied to inlet port 17, it is injected into the fluid as it passes through the injector.

20 In a preferred embodiment of the invention, a flexible tube 16 is attached between an outlet port 19 of ozone generator 12 and inlet port 17 of injector 14. As the vacuum described above is created in inlet port 17 by the flow of water through injector 14, the vacuum draws gas from the outlet port 19 of ozone generator 12 through tube 16.

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It is known that ozone can be created from oxygen in ambient air by subjecting the air to short wavelength ultraviolet light (ie. light having a wavelength of between about 100 - 200 nm). As shown in Figure 2, in the embodiment of the invention described herein ozone generator 12 comprises a housing 30 containing an ultraviolet (UV) lamp 32. When UV lamp 32 is "on", ozone is generated within housing 30 from oxygen contained therein.

A pressure differential switch 34 is wired in series between UV lamp 32 and a power cord 22 extending between generator 12 and power supply 20. Pressure differential switch 34 is mounted on a wall of housing 30 so that it may sense a difference in pressure between the ambient air outside housing 30, and the gas within housing 30. It will be appreciated that pressure differential switch 34 closes when a predetermined pressure differential exists, allowing current to flow to UV lamp 32, lighting it.

In the preferred embodiment, housing 30 of ozone generator 12 is essentially an air-tight box, but for air inlet port 40 (Figure 3) which allows ambient air to pass into housing 30. To prevent the air which is drawn into housing 30 from escaping immediately through outlet port 19 without having been subjected to UV light from lamp 32, a baffle is fitted within housing 30, largely compartmentalizing it.

Baffle 36 extends from the end of housing 30 which bears air

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inlet port 40 almost to the opposing end. Air entering through inlet port 40 must consequently travel around the end of baffle 36 and then past lamp 32 before being drawn out of housing 30 through generator outlet port 19. Baffle 36 also provides a convenient mounting surface for the ballast 37
5 and sockets 38 for UV lamp 32.

When a user turns on a washing machine, valves in the machine open and water begins to flow from the household water supply to the machine. In a typical household, the water pressure of the water
10 supply is in the range of 50-90 psi.

It should be appreciated from the foregoing description that as water flows through injector 14, this water pressure drops, but a vacuum is consequently created in inlet port 17, and in turn, within tube 16 and
15 within ozone generator 12. Pressure differential switch 34 senses this vacuum, and closes, allowing current to flow to UV lamp 32, turning it on, thereby creating ozone from the oxygen in the gas then within housing 30.

Ozone-rich gas is drawn from housing 30 by the vacuum
20 through outlet port 19 and tube 16 and injected into the wash water as it passes through injector 14. Preferably, tube 16 is constructed of an ozone-resistant material.

It will also be appreciated that as soon as water stops flowing
25 through injector 14 (ie. when the washing machine has been filled with the

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necessary amount of water), the pressure differential switch senses the lack of vacuum, and opens, turning UV lamp 32 off, thereby stopping the production of ozone.

5 In this manner, ozone is provided to the water entering the washing machine. Ozone is produced only when required, however.

 It will be appreciated that ozone concentration in the housing 30 will increase to a plateau level within a certain period of time. It is of course preferable that this time, or "lag period" be short; ie. a small fraction of the time it takes to fill the washing machine with ozonated water. The volume of housing 30, and the rate of production of ozone of UV lamp 32 will affect this lag period.

15 To minimize this lag period, a timer switch 42 may be wired in parallel with pressure differential switch 34, and the UV lamp of the ozone generator may be turned on by the user with timer switch 42 for a period of time prior to turning on the washing machine, allowing the ozone concentration to increase within housing 30 before any gas is drawn from housing 30 by the vacuum created by the flow of water through injector 14.

 Any switch could be used in place of timer switch 42, but a non-timer switch has the disadvantage of perhaps being left on inadvertently, wasting energy and allowing potentially harmful levels of ozone to

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escape out of housing 30 into the ambient air. Timer switch 42 may be conveniently mounted on a lid 31 of housing 30, as shown, allowing easy access to a user. Lid 31 is preferably easily removable from the remainder of housing 30, allowing a user to service the generator when necessary (for
5 example, when the UV lamp 32 requires replacement).

To allow a user to easily notice when the generator is in operation, and when the UV bulb 32 is burnt out and in need of replacement, a peephole 44 (Figure 1) may be provided in lid 31. Peephole 44 is
10 preferably formed of a transparent material covering a hole formed through lid 31; this does not allow ambient air into housing 30. Peephole 44 allows a user to see when UV light 32 is on.

It may be readily understood that injector 14 may be inserted
15 within either one of the water hoses passing between the water supply and the washing machine (preferably the cold line, since ozone works better with cold water). However, as shown in Figure 1, injector 14 is preferably fitted into both lines by use of Y-shaped fittings 15a, 15b which serve to combine the cold and hot water flows. While this results in only warm
20 water being available to the user, hot water is not required in any case, again, due to the efficacy of ozone in colder water. Also, the combining of the hot and cold water flows in this manner has the effect of increasing the water pressure at the inlet end of injector 14, and causes a larger pressure drop over injector 14, and a larger vacuum being created, thereby drawing
25 more ozone into the wash water.

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As will be apparent to those skilled in the art in the light of the foregoing disclosure, many alterations and modifications are possible in the practice of this invention without departing from the spirit or scope
5 thereof. As noted above, it has been determined by the inventors of the present invention that given the typical range of water pressures found in household water systems, an injector having the characteristics of the MazzeiTM Model 384 injector provides suitable water flow rates to produce a suitable vacuum for the system, given the water pressures found in most
10 homes.

The ozone generator which has been found in a preferred embodiment to produce ozone at a suitable rate for home laundry systems comprises a UV lamp which produces ozone at a rate of 1.3 grams of
15 ozone per hour, and a pressure differential switch which senses a pressure differential of 3" H₂O.

It will be appreciated, however, that these elements could be varied without departing from the invention. For example, a plurality of
20 lamps can take the place of the single lamp described in this system. A plurality of lamps produces more ozone, and a lower vacuum would thus be necessary to draw off a suitable amount of ozone from the generator, allowing the use of a different injector. As another example, although tube
16 is preferably flexible, it does not have to be.

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Accordingly, the scope of the invention is to be construed in accordance with the substance defined by the following claims.

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WHAT IS CLAIMED IS:

1. An ozonation system for a laundry system having a water supply and a washing machine, said ozonation system comprising:
 - (a) a power supply;
 - 5 (b) an ozone generator comprising a housing, at least one lamp fitted within said housing for producing ultraviolet light within said housing, and a pressure differential switch wired between said power supply and said lamp, said switch sensitive to the pressure differential within said housing and without;
 - 10 (c) means for injecting ozone generated by said ozone generator into the water flowing from said water supply into said washing machine.
2. An ozonation system as described in claim 1, wherein said ozone
15 generator further comprises an outlet port formed in said housing and said means for injecting ozone comprises:
 - (a) a venturi-type differential pressure injector interposed between said water supply and said washing machine; and
 - (b) an ozone-resistant tube fitted between said outlet port and said
20 injector.
3. An ozonation system as described in claim 2, wherein said ozone generator further comprises:
 - (a) an air inlet port formed in said housing; and
 - 25 (b) a baffle fitted within said housing, said air inlet port and said

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outlet port separated by said baffle.

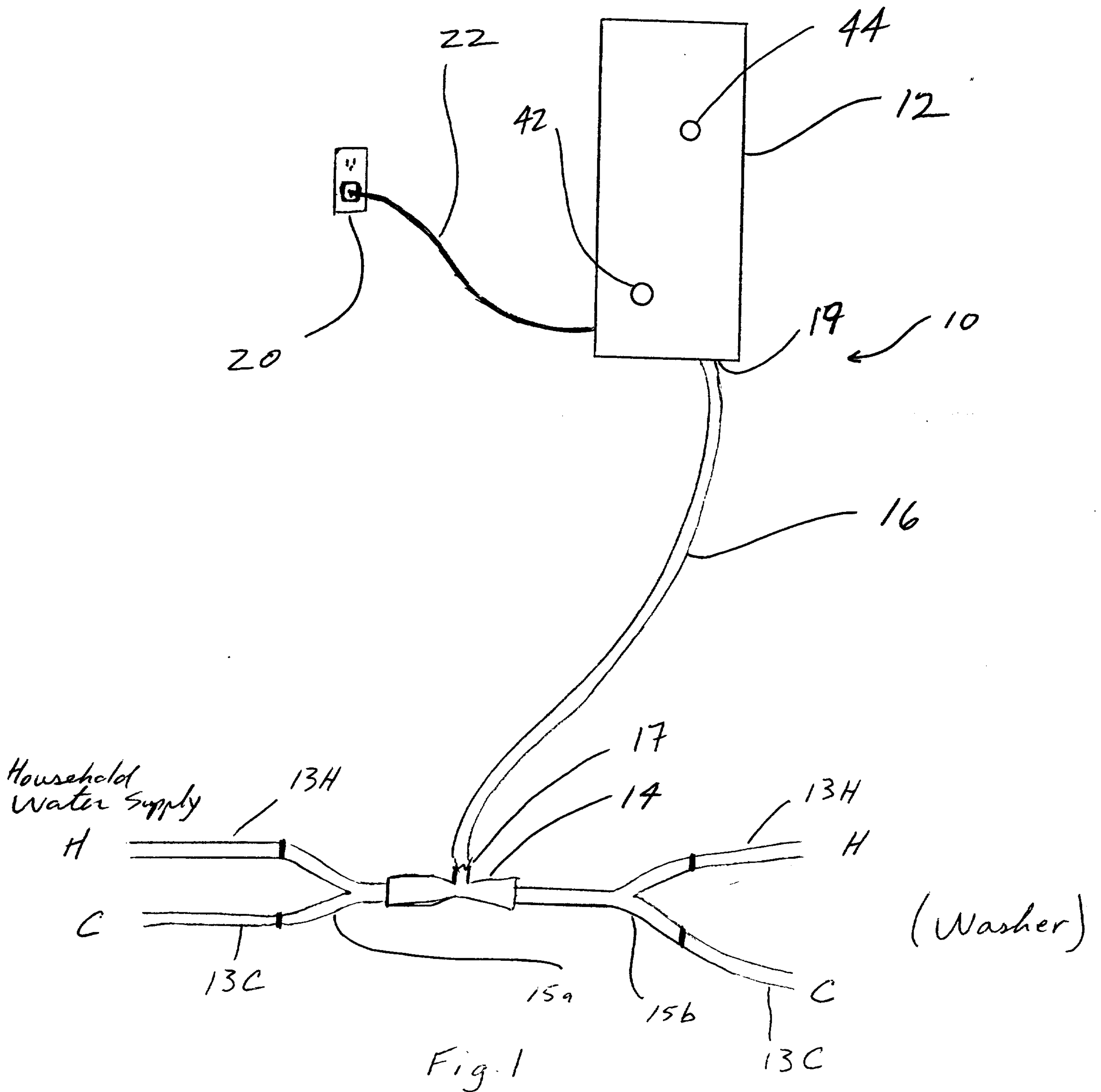
4. An ozonation system as described in claim 3, wherein said ozone generator further comprises a timer switch wired in parallel with
5 said pressure differential switch between said power supply and said lamp.
5. An ozonation system as described in claim 4, wherein said housing comprises a removable lid.
10
6. An ozonation system as described in claim 5, further comprising a peephole formed in said lid.
7. An ozonation system as described in claim 6 wherein said water
15 supply comprises hot and cold water sources and hoses extending therefrom, and a Y-fitting attached between said hoses and said injector.
8. An ozonation system as described in claim 3, wherein said lamp is
20 mounted on said baffle.
9. A method of ozonating water flowing from a water supply into a washing machine, comprising the steps of:
 - (a) beginning the flow of water into said washing machine from
25 said water supply, thereby creating a vacuum in a venturi-type

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differential pressure injector interposed between said water supply and said washing machine;

- 5 (b) providing a switch which closes in the presence of said vacuum, said switch when closed thereby completing an electrical circuit which includes an ultraviolet lamp contained within a housing containing gas having an oxygen content, thereby causing said lamp to emit ultraviolet light within said housing, thereby creating ozone from said oxygen;
- 10 (c) injecting said ozone created by said lamp in said housing into said water by allowing said ozone to be drawn by said vacuum from said housing through said injector and into said water.

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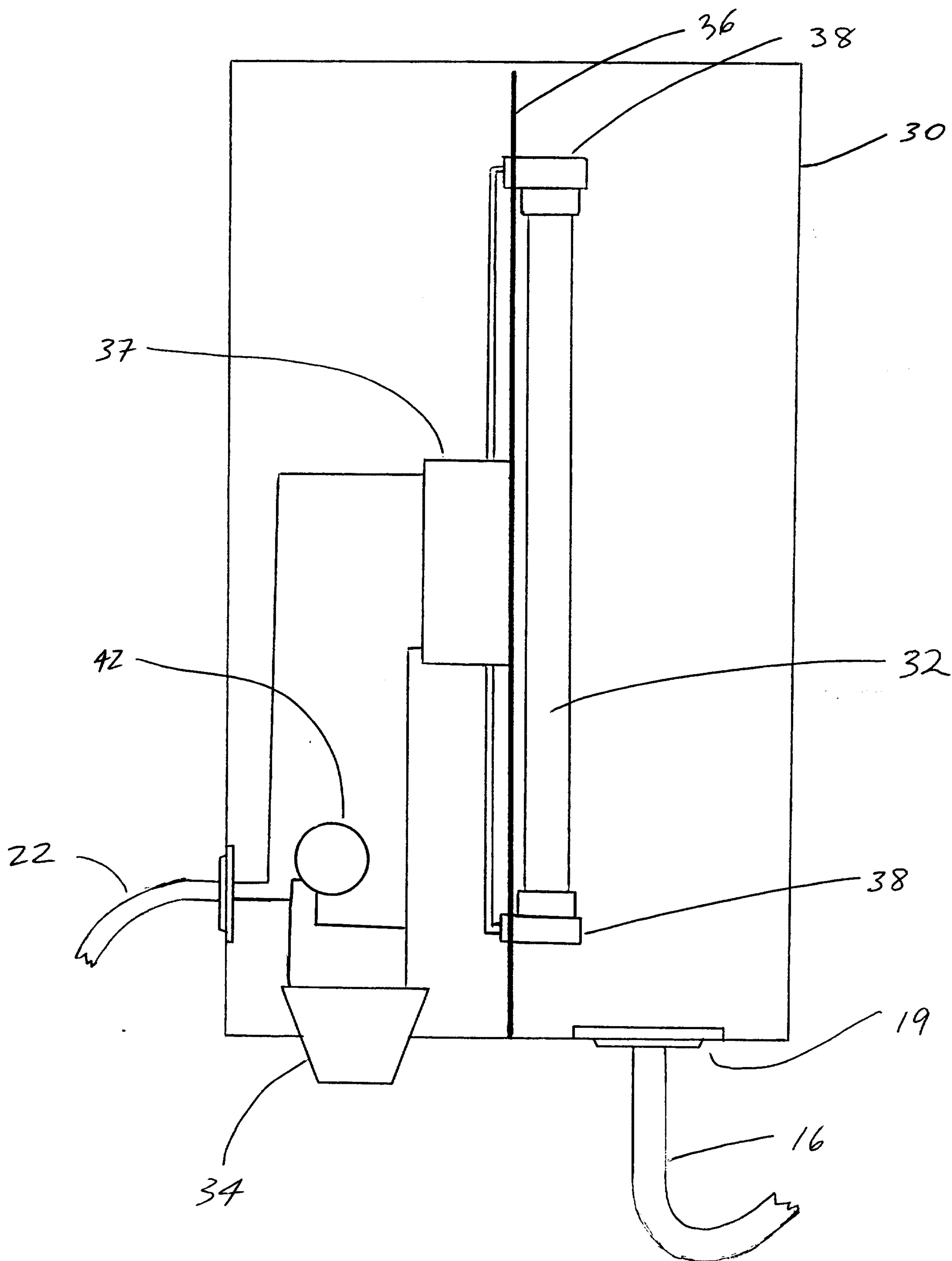


Fig. 2

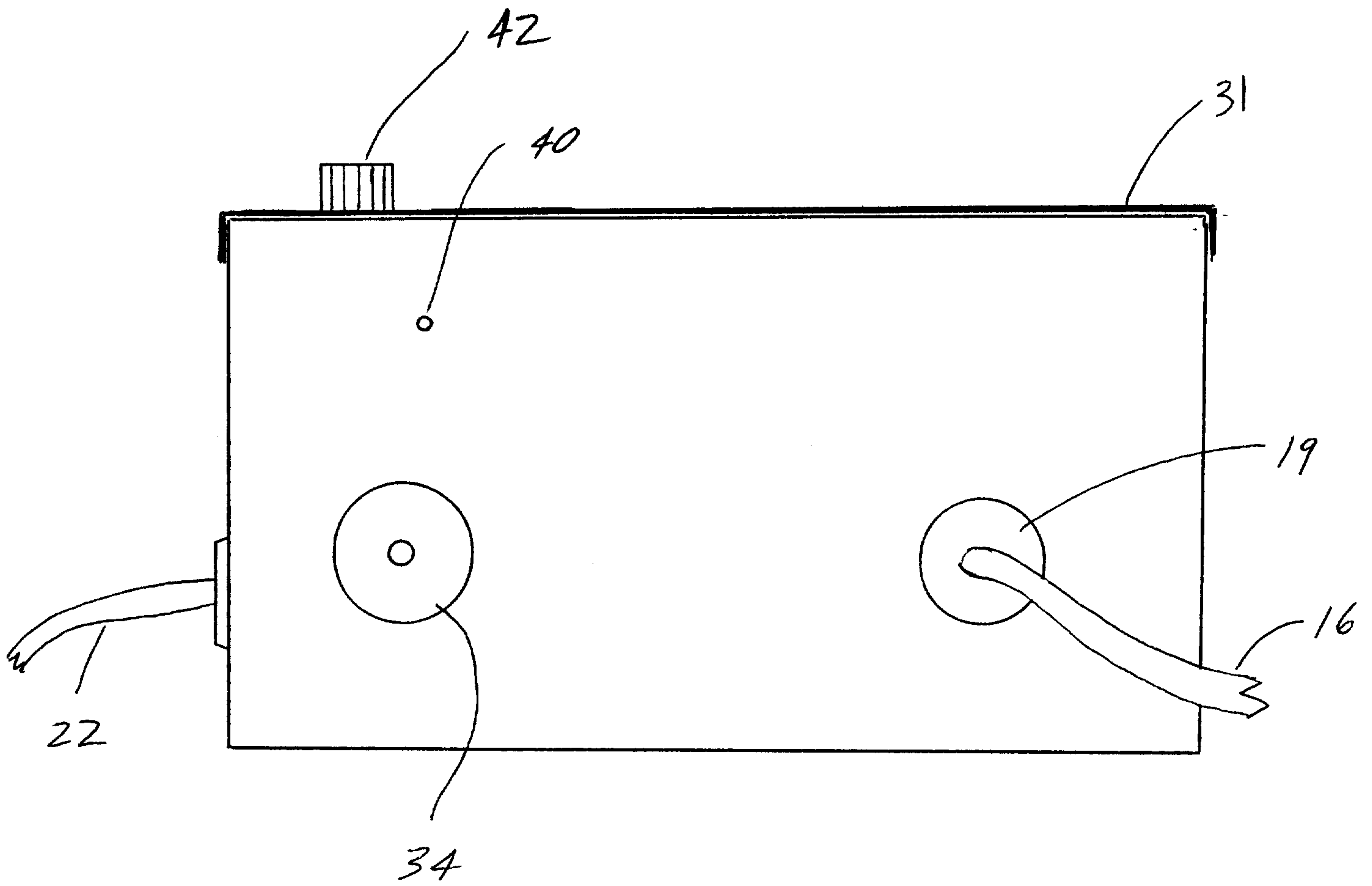


Fig. 3

