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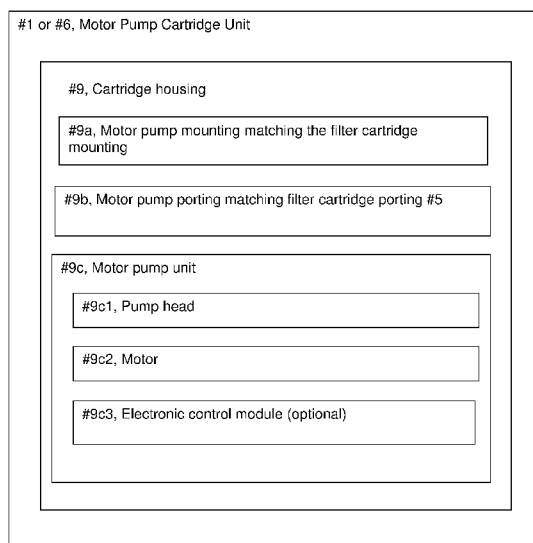


Figure 2D: Motor Pump Unit Cartridge

(57) Abstract: The present invention provides a pump cartridge, which is directly connected in-line with one or more filter cartridges in a mounting bracket. It may be paired with an accumulator tank for a pump version, and with no accumulator tank for a smart pump version. The inline design reduces the size of the system, the amount of connections, and the amount of hose required to install the system, which in turn reduces the space required for installation, the number of potential leak paths, and the likelihood of failure of the system due to issues with the hose.

WO 2016/191731 A1

CARTRIDGE PUMP

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims benefit to provisional patent application serial nos. 62/166,988 (911-005.084-1//F-FLJ-X0020), filed 27 May 2015, which is incorporated
5 by reference in their entirety.

BACKGROUND OF THE INVENTION

1. Field of Invention

The present invention relates to a pump; and more particularly relates to a
10 cartridge pump.

2. Description of Related Art

Figure 1 shows an installation that is known in the art, e.g., including a non-carbonated beverage dispenser, a soda dispenser, a coffee brewer that are
15 arranged and coupled in relation to an ice maker, a combination of a water supply, a booster and a filter system and a carbonator pump. In the installation, the distance between the water booster and the filter system can be any length as space requires.

In operation, booster systems in the beverage market are designed to provide
20 a water supply at a constant pressure, to carbonators, ice makers, non-carbonated drink dispensing valves, coffee/tea brewers, etc. In Figure 1, the typical booster system has the pump and the accumulator tank connected to the filter system that then distributes the water to the aforementioned devices. The current installation requires the pump and accumulator tank to be mounted separately from the filters or
25 filtering system.

Some of the shortcomings of the above mentioned installation and devices include the following:

Currently, the booster systems are separately mounted from the filtering system through a series of multiple connections and hoses, see Figure 1. In effect, this means running tubing and manually plumbing the units in place. Each of these connections is a potential leak path for the overall system and any length of hose is prone to snagging, kinking, or rupture. Figure 4 shows a few of the many systems that are currently in the market for boosting water pressure, e.g., in Figs 4A through 4D. They are costly, bulky, and usually consist of many components. Repair and maintenance are complicated and often the entire unit must be replaced. See Figures 4 and 5 that show current configurations of pumps and filters, e.g., including Figs 5A through 5D.

SUMMARY OF THE INVENTION

In summary, the present invention may consist of a cartridge style pump that may be plumbed directly into a filter manifold. The pump can be an intelligent pump that would remove the need for an accumulator tank from the system. The connection would allow for direct porting and reduce line loss, and the requirement to remotely mount and plumb the boost system, as well as reduce potential leak paths.

20

Examples of Particular Embodiments

According to some embodiments, and by way of example, the present invention may include, or take the form of, a system, that features a new and unique pump cartridge, a filter cartridge and an inline mounting bracket combination.

The pump cartridge may include a cartridge housing configured with a motor pump unit arranged therein for pumping a fluid in the system, the pump cartridge configured with a pump cartridge mounting, and with a pump cartridge porting to receive the fluid and provide pumped fluid.

5 The filter cartridge may be configured to receive and filter the pumped fluid and provide filtered pumped fluid, the filter cartridge configured with a filter cartridge mounting and with filter cartridge porting to receive the pumped fluid and provide filtered pumped fluid, the pump cartridge mounting and the filter cartridge mounting being configured to substantially match; the pump cartridge porting and the filter
10 cartridge porting also being configured to substantially match.

The inline mounting bracket may include inline cartridge mounting units and inline mounting bracket ports arranged inbetween for providing associated fluid from one inline cartridge mounting unit to an adjacent inline cartridge mounting unit. Each of the inline cartridge mounting units may be configured to mount either the pump
15 cartridge or the filter cartridge. One inline cartridge mounting unit may be configured to receive the pump cartridge mounting so that the pump cartridge porting aligns with a set of the inline mounting bracket ports. Another inline cartridge mounting unit configured to receive the filter cartridge mounting so that the filter cartridge porting aligns with a corresponding set of the inline mounting bracket ports.

20 By way of example, the system may include one or more of the following features:

The pump cartridge may include a smart pump having an electronic controller configured therein so that the pump cartridge provides the pumped liquid with a predetermined pumping functionality, including a constant flow and pressure.

The controller may be configured with a variable speed control to adjust the speed in response to a change in the pump head pressure in order to maintain the constant flow and pressure.

5 The controller may be configured to respond to a pressure signal containing information about the pressure of the pumped liquid.

The system may include an accumulator configured to receive and accumulate the fluid pumped by the pump cartridge.

The system may form part of a beverage dispensing system, or a reverse osmosis system, a water filtration system.

10 At least one inline cartridge mounting unit may be configured to receive the pump cartridge mounting, which is rotated therein so that the pump cartridge porting aligns with the set of corresponding inline mounting bracket ports.

At least one inline cartridge mounting unit may be configured to receive the filter cartridge mounting, which is rotated so that the filter cartridge porting aligns with
15 the set of corresponding inline mounting bracket ports.

Solution to Problem in the Art

The present invention overcomes the above mentioned difficulties as follows:

By way of example, the present invention may be utilized in many different
20 applications such as reverse osmosis (RO), water filtration, residential areas where low water pressure is an issue etc.

BRIEF DESCRIPTION OF THE DRAWING

The drawing includes Figures 1-5C, which are not necessarily drawn to scale,
25 which are briefly described as follows:

Figure 1 shows a diagram of an installation of a booster system having a pump and an accumulator mounted separately from filters that is known in the art.

Figure 2A shows a system having a combination of a motor pump unit/cartridge, an accumulator cartridge and two filter cartridges configured in relation to an inline mounting bracket, according to the present invention.

Figure 2B shows the combination of the motor pump unit/cartridge, the accumulator cartridge and the two filter cartridges configured in relation to the inline mounting bracket for implementing in a beverage application like that shown in Figure 2A, according to the present invention.

Figure 2C shows a combination of a motor pump unit/cartridge, two filter cartridges and an accumulator cartridge configured in relation to an inline mounting bracket, for implementing in a reverse osmosis (RO) application, according to the present invention.

Figure 2D shows a motor pump unit cartridge having cartridge mountings for matching a filter cartridge mounting, porting for matching filter cartridge porting, and also having a motor pump unit, according to some embodiments of the present invention.

Figure 2E is a photograph of a filter cartridge that is disassembled and has a cartridge housing and a cartridge mounting cap, according to some embodiments of the invention.

Figure 2F is a photograph of a bottom enlarged view of the cartridge mounting cap in Figure 2E, showing 1st and 2nd mounting cap ports, according to some embodiments of the invention.

Figure 3 shows a combination of a motor pump unit/cartridge, having an electronic/intelligent controller, and two filter cartridges configured in relation to the inline mounting bracket, according to the present invention.

Figure 4 includes Figs 4A through 4D, which show diagrams of booster
5 system that are known in the art.

Figure 5 includes Figs 5A through 5C, which show diagrams of mounting brackets and cartridges system that are known in the art.

Not every element or arrow in every Figure is labeled with a lead line and reference numeral/label, so as to reduce clutter in the drawing.

10

DETAILED DESCRIPTION OF BEST MODE OF THE INVENTION

Detailed Description of the Operation of the Present Invention:

In summary, the present invention may take the form of, or consist of, one or more pump cartridge, which are directly connected in-line with one or more filter
15 cartridges. They may be paired with an accumulator tank for a pump version, and with no accumulator tank for a smart pump version. The inline mounting bracket design reduces the size of the system, the amount of connections, and the amount of hose required to install the system, which in turn reduces the space required for installation, the number of potential leak paths, and the likelihood of failure of the
20 system due to issues with the hose. The reader is referred collectively to the embodiments shown in Figures 2A through 3.

Figures 2A and 2B: Beverage Applications

Consistent with that set forth above, Figure 1 show an overall view of the
25 current known system, and Figure 2A show an overall view of a system generally

indicated as 10 according to the present invention. In the current system shown in Figure 1, the booster system is mounted separately from the filtration system. In contrast, the system 10 according to the present invention shown in Figure 2A includes a combination generally indicated as 20 of cartridges for the pump, the accumulator tank, and the filter unit(s), which may be installed inline allowing for easier installation, maintenance, repair, and cartridge replacement.

Figures 2A, 2B and 2C show systems 20, 20' that may include the following:

#1) Pump cartridge (aka the motor pump unit cartridge) that may be configured or designed as a modular pump system arranged or contain in a standard cartridge housing, e.g., like that used for a filter cartridge. By way of example, the motor pump unit cartridge (#1) may be configured with porting, e.g., including input and output ports, that can be directly connected to corresponding ports in the filter systems in which it is implemented. By way of example, this motor pump unit cartridge (#1) may utilize a quick connect pump head that is known in the art and easily serviced. By way of example, see Figure 2D, the pump head (#9c1) that forms part of the motor pump unit (#9c) arranged or contained in the cartridge housing (#9).

#2) Accumulator cartridge (#2) that may be configured as, or would consist of, an accumulator tank designed to fit into the filter configuration of the filter systems in which it is implemented. By way of example, in an RO system 20' like that shown in Figure 2C, the accumulator tank (#2) may be after the filters (#3) as shown in Figure 2C.

#3) Typical filter cartridges that are known in the art, and available on the market. In effect, the scope of the invention is not intended to be limited to any particular type or kind of filter cartridge either now known or later developed in the

future. Examples of the filter cartridge are disclosed in Figure 5 below, as well as the U.S. patent documents, and other references set forth below.

#4) Typical mounting brackets that are known in the art, and available on the market. In effect, the scope of the invention is not intended to be limited to any particular type or kind of mounting bracket either now known or later developed in the future. Examples of other mounting brackets are also disclosed in the U.S. patent documents, and other references set forth below.

#5) Porting that is configured for fluidicly coupling or connecting the pump cartridge (#1), the accumulator (#2) and the filter cartridge (#3) units together mounted in the mounting bracket (#4) that are known in the art. By way of example, such porting (#5) may form an integrate part of the mounting bracket (#4), including those currently available on the market.

Figures 2B and 2C shows combinations 20 and 20' of typical installations, e.g. using the pump and accumulator cartridges mounted in-line with one or more cartridges for the filter(s) for receiving and processing input fluid F_{in} and providing an output fluid F_{out} , $F_{out(RO)}$. In Figure 2B, the combination includes a motor pump unit/cartridge (#1), an accumulator cartridge (#2) and one or more filter cartridges (#3), all configured in series and mounted on the inline mounting bracket (#4) for implementing in a beverage application like that shown in Figure 2A. In Figure 2C, the combination 20' includes the motor pump unit/cartridge (#1), the one or more filter cartridges (#3) and the accumulator cartridge (#2), all configured in series and mounted on the inline mounting bracket (#4) for implementing in a reverse osmosis (RO) application like that shown in Figure 2C.

In Figures 2A, 2B and 2C, the one or more filter cartridges (#3) may include typical filter cartridges for home or commercial use. The inline mounting bracket (#4)

may include, or take the form of, a standard or known mounting bracket for filter installations. The inline mounting bracket (#4) may include the design porting (#5) coupling the motor pump unit/cartridge (#1) and the accumulator cartridge (#2) that matches a filter porting used for assembly and mounting.

5 Figure 2D shows the motor pump unit cartridge (#1) or (#6) that may be configured to include a cartridge housing (#9) having a motor pump mounting (#9a) that matches the filter cartridge mounting, and a motor pump porting (#9b) that matches the filter cartridge porting (#5) and a motor pump unit (#9c). By way of example, the motor pump unit (#9c) may include a pump head (#9c1) that has
10 input/output porting to fit directly in line with, and couple to, the cartridge's porting (#9a) for matching and aligning with the design/filter porting (#5) of the existing filter cartridges like the one or more filter cartridges (#3). The motor pump unit (#9c) also includes a motor (#9c2) for driving the pump head (#9c1). The motor (#9c2) may also include a quick connect to allow for easier pump replacement as needed. It is
15 important to note that the scope of the invention is not intended to be limited to any particular type or kind of motor and/or pump combination; and embodiment are envisioned, and the scope of the invention is intended to include, using a motor and/or pump combination that are now known or later developed in the future. By way of example, the motor and/or pump combination may include, or take the form of
20 a motor and/or pump combination for implementing a diaphragm pumping arrangement, as well as other types or kind of pumping arrangement. The whole thrust of the present invention is to configured such a motor and/or pump combination in a standard cartridge like the cartridge housings used for the accumulator, the filter, etc., and to couple the motor and/or pump combination in the
25 standard cartridge into the inline mounting bracket (#4), e.g., by using a standard

cartridge mounting used for coupling the filter cartridge (#3) to the mounting bracket (#4), as well as a standard design porting (#5) for coupling the motor pump unit/cartridge (#1), the filter cartridge (#3) and the accumulator cartridge (#2) fluidically together that matches the design/filter porting (#5) currently used for assembly and
5 mounting.

By way of example, the following U.S. patent applications disclosure different types or kinds of pump technologies that may be suitably adapted, arranged or implemented, e.g., in a cartridge housing like element (#9) in Figure 2D. See patent application serial nos. 14/794,284; 14/740,577 and 13/895,719, which are all
10 incorporated by reference in their entirety. It is understood, and one skilled in the art would appreciate, that other U.S. patent applications may disclose other types or kinds of pump technologies that may be suitably adapted, arranged or implemented, e.g., in a cartridge housing like element (#9) in Figure 2D, within the spirit of the underlying invention.

15 Figure 2E shows a filter cartridge that is disassembled and has a cartridge housing and a cartridge mounting cap; and Figure 2F shows the cartridge mounting cap in Figure 2E, having 1st and 2nd mounting cap ports. In Figure 2E, the housing cartridge has a filter arranged therein. The cartridge has a cartridge housing mounting end configured with housing mounting end threads, as best shown in
20 Figure 2F. The cartridge mounting cap has cap threads, as shown in Figures 2E and 2F for coupling with the housing mounting end threads of the cartridge when the cartridge housing and the cartridge mounting cap are assembled or screwed together. The cartridge mounting cap has two portings coupled thereto. One porting maybe fluidically coupled to the 1st mounting cap port, and the other porting maybe
25 fluidically coupled to the 2nd mounting cap port, as shown. The portings are also

shown coupled to porting hosing for providing fluids to and from the portings and the cartridge assembly.

By way of example, and according to some embodiments of the present invention, the motor pump unit may be configured into the cartridge housing and its input/output pump porting suitably adapted or coupled to the 1st and 2nd mounting cap ports in order to implement the integration of such a motor pump unit into the inline pumping assembly and provide the inline pumping of fluid in the overall assembly, according to the present invention.

10 Figure 3: Pump Cartridge with Electronic Controls

Figure 3 shows a combination generally indicated as 30 that represents a similar concept, but rather than using an accumulator tank, the system 30 utilizes a motor pump unit generally indicated as (#6) with an intelligent controller, e.g., like electronic control module (#9c3) in Figure 2D. This feature will consist of a combination of a pump head, a motor and a controller, e.g., to provide constant flow and pressure to the system 30 among other pump control functionalities.

In effect, the pump cartridge (#6) with electronic control or controller (#9c3) may be configured to include, or consist of, the pump cartridge (#1) that also includes a controller module like element (#1c) in Figure 2D that may be configured to implement one or more pump control algorithms to perform or provide pump control functionality, e.g., consistent with that set forth below:

In close proximity, the pump cartridge (#6) with electronic controller (#9c3) may be configured to provide immediate response to system conditions.

By way of example, the system 30 may be configured to utilize pre-triggering to prevent instantaneous pressure drops, e.g., when valves are opened to dispense

fluids. In this case, and by way of example, the pump cartridge (#6) with electronic controller (#9c3) may be configured to receive sensed signaling containing information, e.g., about instantaneous pressure drops, when valves are opened to dispense fluids, etc., and also configured to implement one or more suitable pump control algorithms to perform suitable pump control functionality to respond to the same.

By way of further example, the system 30 may be configured to utilize variable speed control to ensure that the flow and/or pressure remain constant to the need. As an example, a beverage dispense valve typically requires 40 PSI to be supplied to the valve at a flow rate of 2.5 ounces per second, with one valve open the pump may only require 25% of the power to meet that need. A typical pump without intelligence that is known in the art will still try to run at full speed using more energy and providing inconsistent flow as more valves are opened. In this case, and by way of example, the pump cartridge (#6) with electronic controller (#9c3) may be configured to receive sensed signaling containing information about speed, flow and/or pressure, etc., and also configured to implement one or more suitable pump control algorithms to perform suitable pump control functionality to respond to the same.

This system 30 may be configured to only use the power needed to provide the flow and pressure, e.g., by implementing suitable control or controller algorithms that forms part of the overall pump electronic control intelligence. In case where more valves may be open at the same time, the pump electronic control or controller may be configured to increase power as needed to maintain the required flow and pressure. Moreover, the pump pressure may be sensed using a pressure switch, transducer or other means of sensing pressure. The pump cartridge's electronic

control or controller may be configured to monitor the pump and detect various operations such as, but not limited to, run dry, over current, over voltage, under voltage, etc., e.g., and implement suitable pump protection algorithms to protect the pump. By way of example, the pump protection algorithms may include, or take the form of, shutting the pump off, providing a suitable audio or visual warning, restarting the pump after a predetermined time increment, cycling the pump on/off, etc. In this case, and by way of example, the pump cartridge (#6) with electronic controller (#9c3) may be configured to receive sensed signaling containing information about power, voltage, current, speed, flow, valve openings, and/or pressure, etc., and also configured to implement one or more suitable pump control algorithms to perform suitable pump control functionality to respond to the same.

The system 30 may also be configured to utilize communications to alert the user of required maintenance or repair. This embodiment would eliminate the need for an accumulator tank as it would be on demand. In this case, and by way of example, the pump cartridge (#6) with electronic controller (#9c3) may be configured to receive sensed signaling containing information about maintenance, repair and/or alerts, etc., and also configured to implement one or more suitable pump control algorithms to perform suitable pump control functionality to respond to the same.

By way of example, the pump cartridge (#1) may include, or consists of, a pump head (#9c1) that has porting to fit directly in line with the existing filter cartridges like element (#3), a motor (#9c2) for driving the pump head (#9c1), and an intelligent electronic controller like element (#9c1) with the features listed above. The motor (#9c2) can also include a quick connect to allow for easier pump replacement as needed. Pump heads and motors are known in the art, and the scope of the invention is not intended to be limited to any particular type or kind

thereof. By way of example, different types of pumps are known to have different types of pump heads, and different types of pumps are known to have different types of motors. One skilled in the art would appreciate and understand, without undue experimentation, how to implement a particular type of pump having a particular type of pump head in combination with a particular type of motor, without undue experimentation, for a particular type of application. By way of example, for a beverage application, one skilled in the art would appreciate and understand, without undue experimentation, how to implement one type of pump having one type of pump head in combination with one type of motor, without undue experimentation.

Alternatively, and by way of further example, for a reverse osmosis application, one skilled in the art would appreciate and understand, without undue experimentation, how to implement another type of pump having another type of pump head in combination with another type of motor, without undue experimentation.

Embodiments are envisioned, and the scope of the invention is intended to include, using the same type of pump having the same type of pump head in combination with the same type of motor, etc. In other words, the scope of the invention is not intended to be limited to the type of pump, the type of pump head, or type of motor used for any particular type of application.

Furthermore, one skilled in the art would appreciate and understand, without undue experimentation, how to implement one or more pump control algorithms to perform or provide the aforementioned pump control functionality, e.g., by using known microprocessor technology and suitable control algorithms and flowcharts.

Signal Processor or Processing Module

By way of example, a signal processor or processing module may be configured at least to:

- 5 receive signaling containing information about suitable sensed signaling; and
- determine corresponding signaling containing information to implement predetermined or desired pump control functionality, based upon the sensed signaling received.

10 In operation, the signal processor or processing module may be configured to provide the corresponding signaling to control the system 30, e.g., to control the motor/pumping functionality.

By way of example, the signal processor or processing module may be configured in, or form part of, the electronic control or controller module.

15 By way of example, the functionality of the signal processor or processing module may be implemented using hardware, software, firmware, or a combination thereof. In a typical software implementation, the signal processor or processing module would include one or more microprocessor-based architectures having, e. g., at least one signal processor or microprocessor like element. One skilled in the art
20 would be able to program with suitable program code such a microcontroller-based, or microprocessor-based, implementation to perform the functionality described herein without undue experimentation. For example, the signal processor or processing module may be configured, e.g., by one skilled in the art without undue
25 experimentation, to receive the signaling containing information about the suitable sensed signaling for further processing, consistent with that disclosed herein.

Moreover, the signal processor or processing module may be configured, e.g., by one skilled in the art without undue experimentation, to determine the corresponding signaling containing information to implement the predetermined or desired pump control functionality, based upon the sensed signaling received,
5 consistent with that disclosed herein.

The scope of the invention is not intended to be limited to any particular implementation using technology either now known or later developed in the future. The scope of the invention is intended to include implementing the functionality of the processors as stand-alone processor, signal processor, or signal processor
10 module, as well as separate processor or processor modules, as well as some combination thereof.

The system may also include, e.g., other signal processor circuits or components, including random access memory or memory module (RAM) and/or read only memory (ROM), input/output devices and control, and data and address
15 buses connecting the same, and/or at least one input processor and at least one output processor, e.g., which would be appreciate by a person skilled in the art.

Possible Applications:

Possible Applications may include one or more of the following: Beverage
20 boost systems, or home booster/filters.

By way of example, and for the sake of understanding that disclosed herein, the present invention is described in relation to the beverage market and installation of such a system. By way of example, this disclosure also shows using only two filters mounted, but there can be as many as needed, as a one skilled in the art
25 would appreciate.

Other Filter Cartridge and Manifold Technology

In addition to the booster systems, mounting brackets and cartridges shown in Figure 4-5 herein, the following are other filter cartridge and manifold technology that are known in the art and provided by way of further example.

5 For example, the reader is also referred to U.S. Patent No. 7,387,210, as well as the following other U.S. Patent nos. 7,651,070; 7,992,667; 8,097,158; 8,298,420; 8,372,273; 8,585,071; 8,911,623; 8,945,383; 8,951,415; 9,044,699; 9,345,995, which are all incorporated by reference in their entirety.

10 See also U.S. Patent nos. 7,225,936, D755,344; and D755,922, which are also all incorporated by reference in their entirety.

For the sake of completeness, all of the references cited in section (56) of all the aforementioned U.S. patents are also all incorporated by reference in their entirety.

15 See also a Beverage Master Parts List, issued 9 March 2012, by Manitowoc[®], doing business at 21 Future Dr., Sellersburg, IN 47172; as well as a Dual Flow Manifold Systems Instruction Manual for DF1XX and DF2XX high flow series manifolds and water filtration systems, copyright in 2012, by 3M Purification, Inc. doing business at 400 Research Parkway, Meriden, CT 06450, which are also both incorporated by reference in their entirety.

20 A prior art search was also conducted, and the following U.S. patents or U.S. patent publications were developed therein: 8,893,927; 8,881,958; 8,857,674; 8,800,820; 8,561,841; 8,327,607; 8,061,567; 7,980,425; 7,594,525; 7,472,805; 7,331,483; 6,244,474; 2014/0305316; 2013/0092282; 2012/0305605; 2012/0102999; 2009/0104336; 2008/0283550; and 2008/0149669, which are also all incorporated
25 by reference in their entirety.

The Scope of the Invention

While the invention has been described with reference to an exemplary embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without
5 departing from the scope of the invention.

In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment(s) disclosed herein as the best mode contemplated for carrying out this
10 invention.

WHAT IS CLAIMED IS:

1. A system comprising:

a pump cartridge having a cartridge housing configured with a motor pump unit arranged therein for pumping a fluid in the system, the pump cartridge
5 configured with a pump cartridge mounting, and with a pump cartridge porting to receive the fluid and provide pumped fluid;

a filter cartridge configured to receive and filter the pumped fluid and provide filtered pumped fluid, the filter cartridge configured with a filter cartridge mounting and with filter cartridge porting to receive the pumped fluid and provide filtered
10 pumped fluid, the pump cartridge mounting and the filter cartridge mounting being configured to substantially match; the pump cartridge porting and the filter cartridge porting also being configured to substantially match; and

an inline mounting bracket having inline cartridge mounting units and inline mounting bracket ports arranged inbetween for providing associated fluid from one
15 inline cartridge mounting unit to an adjacent inline cartridge mounting unit, each of the inline cartridge mounting units being configured to mount either the pump cartridge or the filter cartridge, one inline cartridge mounting unit configured to receive the pump cartridge mounting so that the pump cartridge porting aligns with a set of the inline mounting bracket ports, and another inline cartridge mounting unit
20 configured to receive the filter cartridge mounting so that the filter cartridge porting aligns with a corresponding set of the inline mounting bracket ports.

2. A system according to claim 1, wherein the pump cartridge comprises a smart pump having a controller configured therein so that the pump cartridge provides the pumped liquid with a predetermined pumping functionality, including a constant flow and pressure.

5

3. A system according to claim 2, wherein the controller is configured with a variable speed control to adjust the speed in response to a change in the pump head pressure in order to maintain the constant flow and pressure.

10

4. A system according to claim 2, wherein the controller is configured to respond to a pressure signal containing information about the pressure of the pumped liquid.

15

5. A system according to claim 1, wherein the system comprises an accumulator configured to receive and accumulate the fluid pumped by the pump cartridge.

20

6. A system according to claim 1, wherein the system forms part of a beverage dispensing system.

7. A system according to claim 1, wherein the system forms part of a reverse osmosis system, a water filtration system.

8. A system according to claim 1, wherein at least one inline cartridge mounting unit is configured to receive the pump cartridge mounting, which is rotated therein so that the pump cartridge porting aligns with the set of corresponding inline mounting bracket ports.

5

9. A system according to claim 1, wherein at least one inline cartridge mounting unit is configured to receive the filter cartridge mounting, which is rotated so that the filter cartridge porting aligns with the set of corresponding inline mounting bracket ports.

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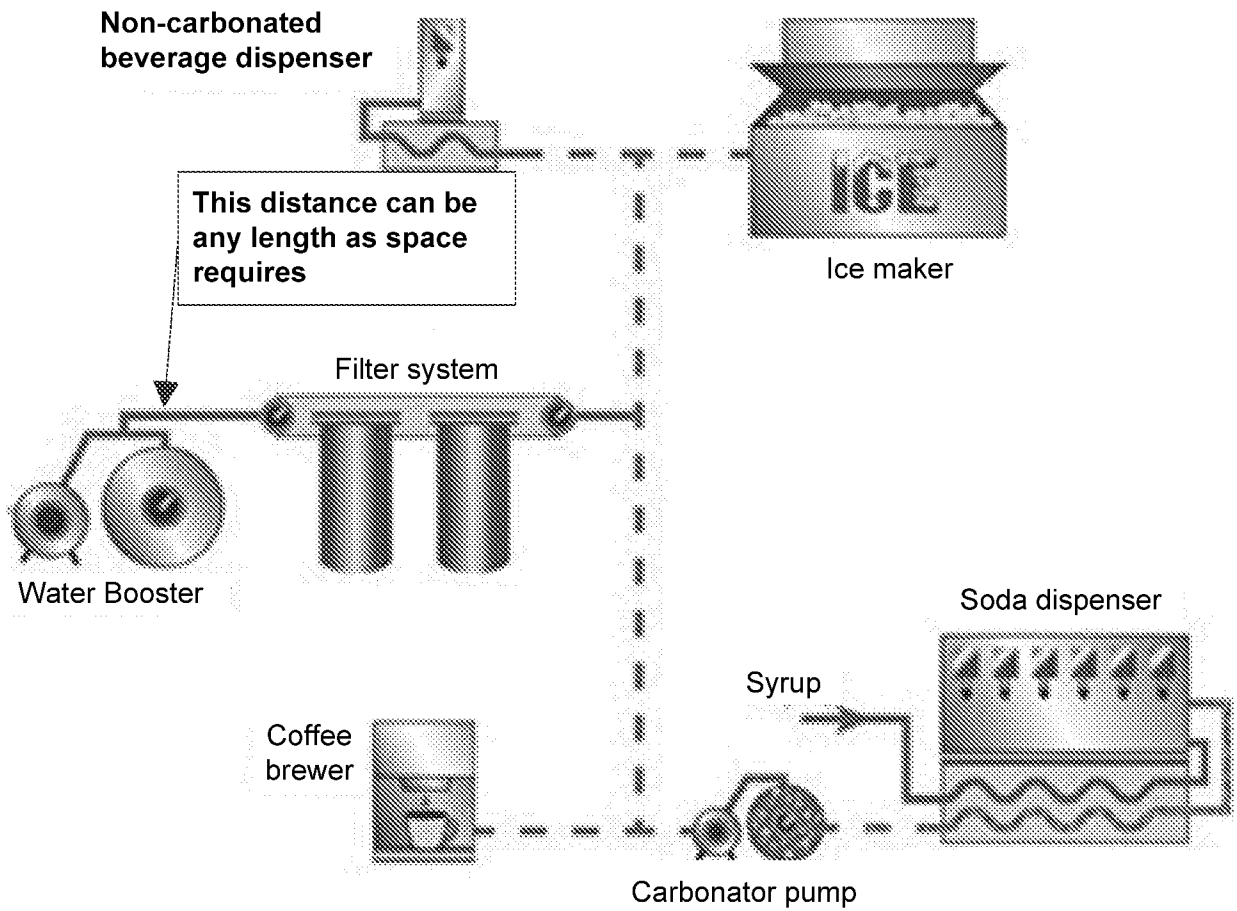


Figure 1 (Prior Art)

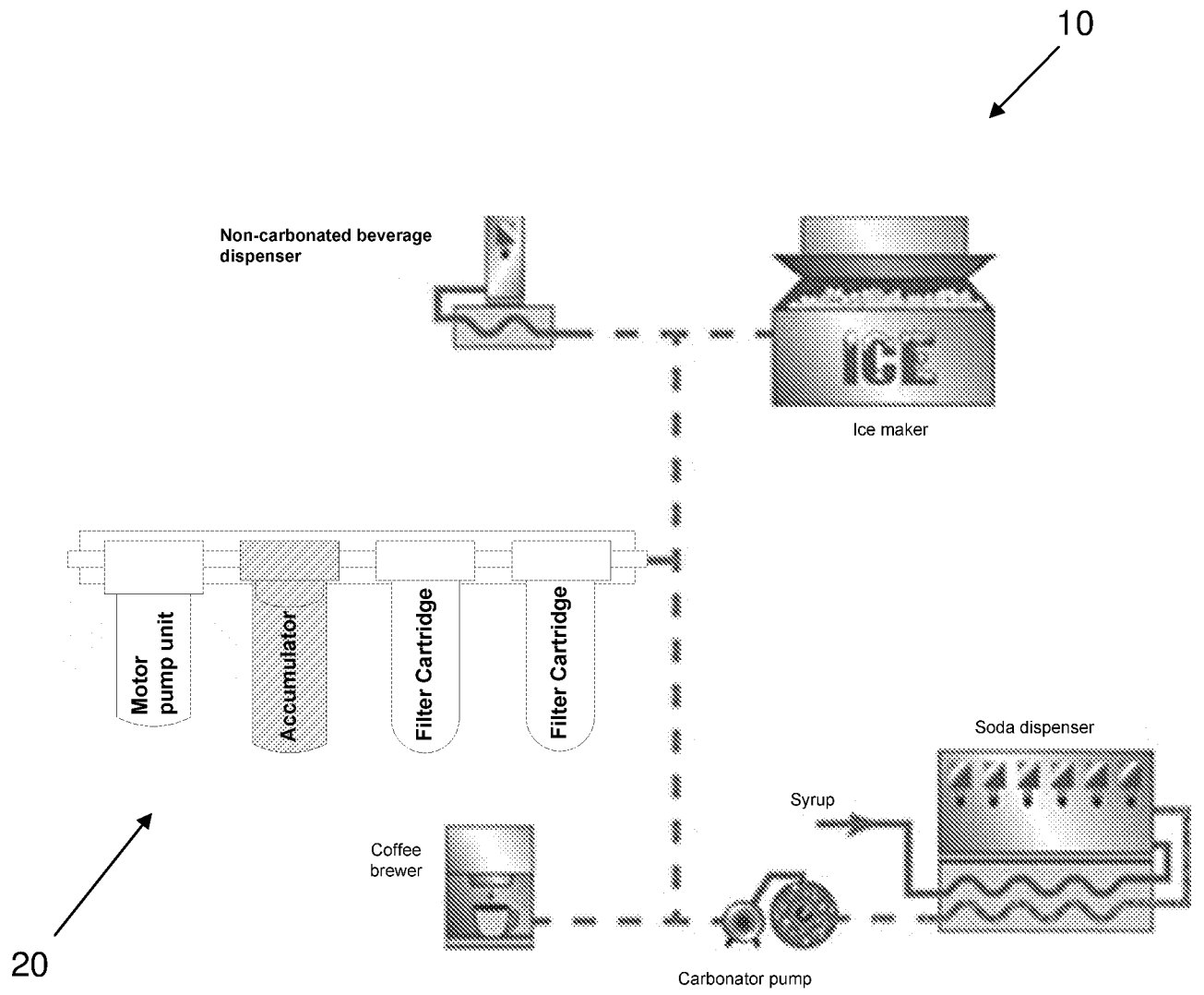


Figure 2A

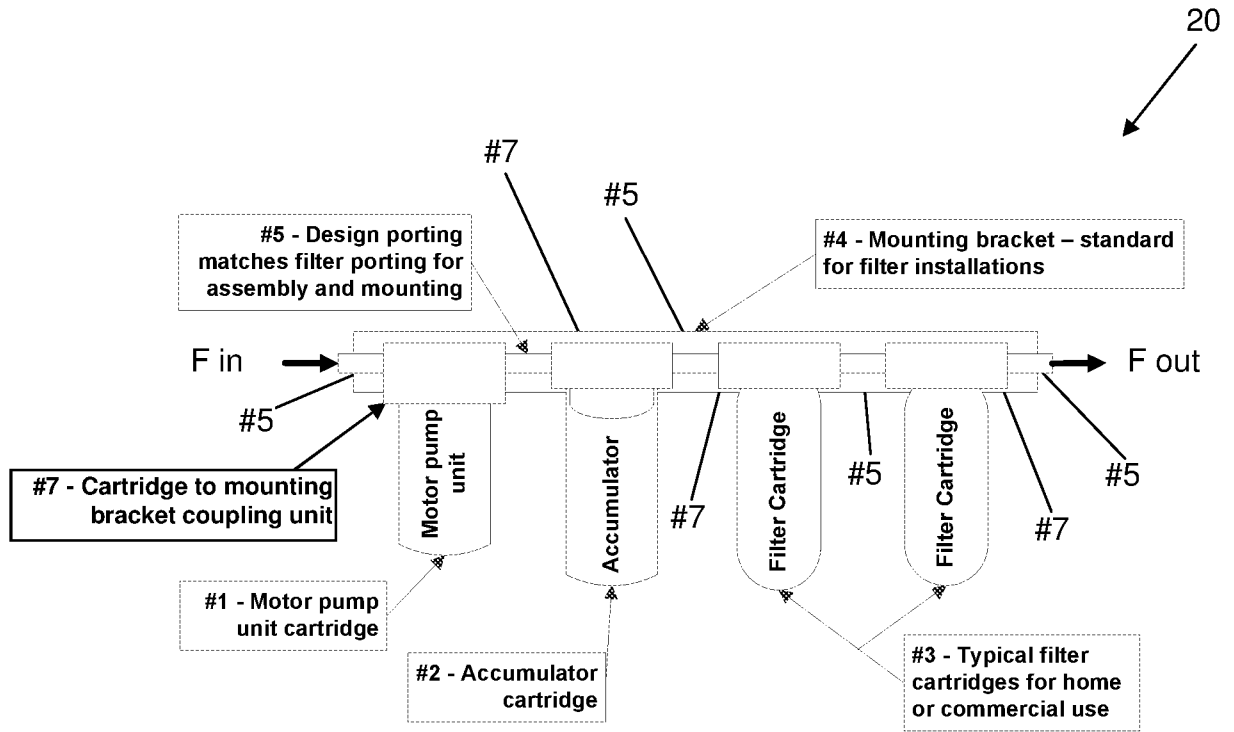


Figure 2B: Beverage Application

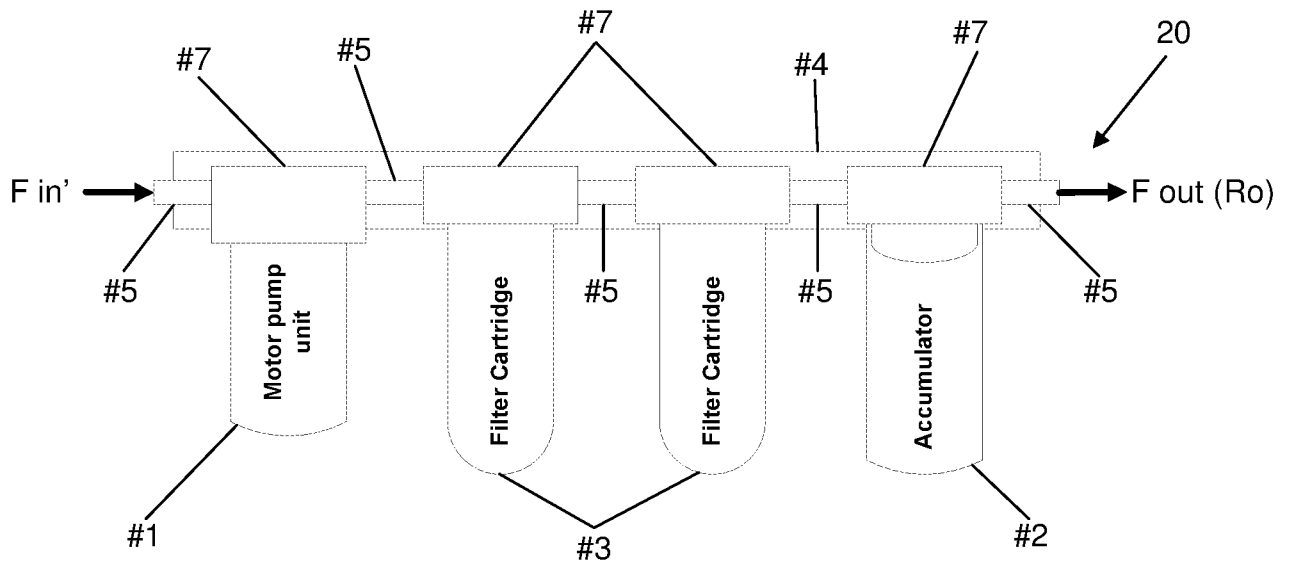


Figure 2C: RO Application

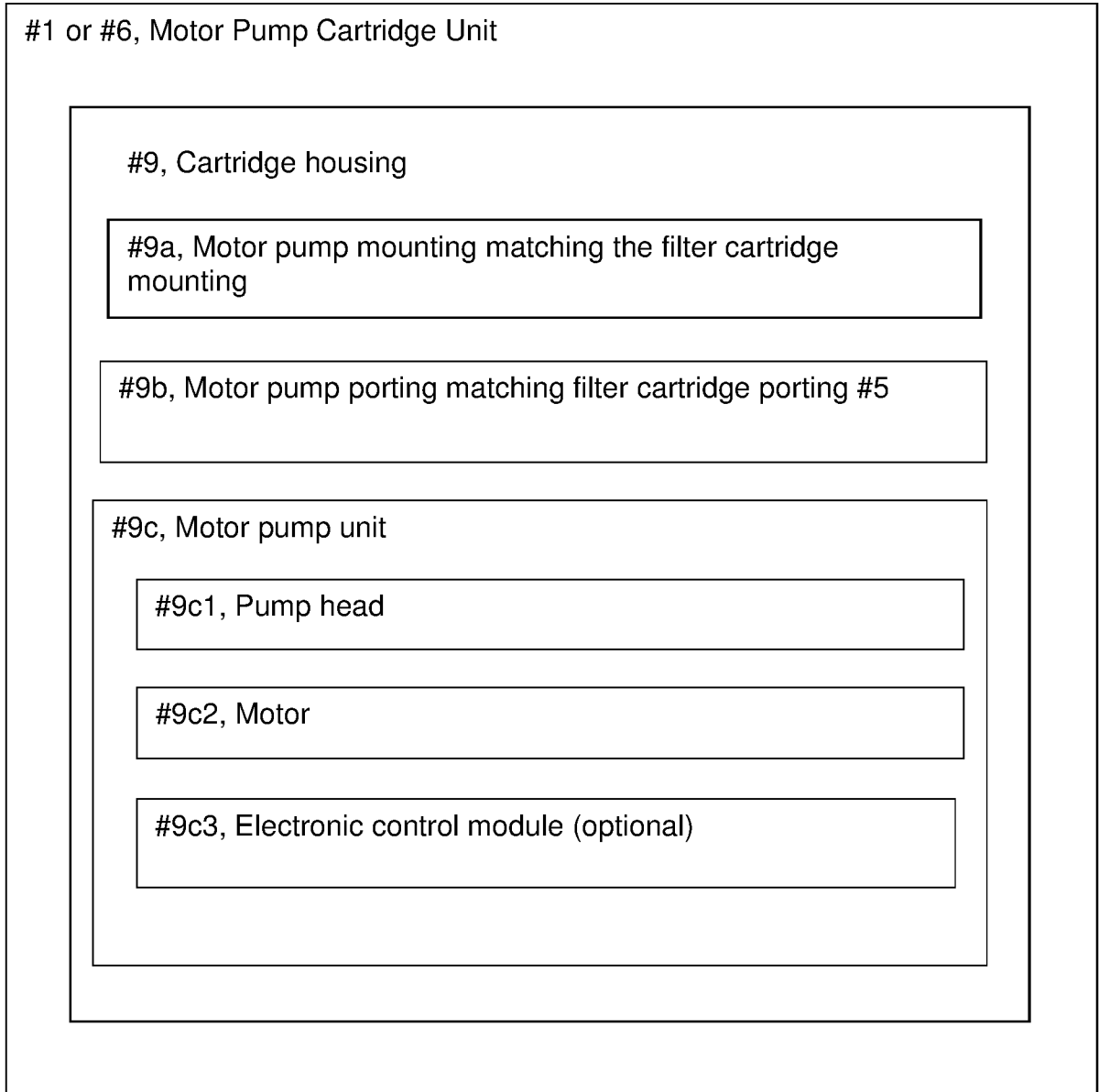
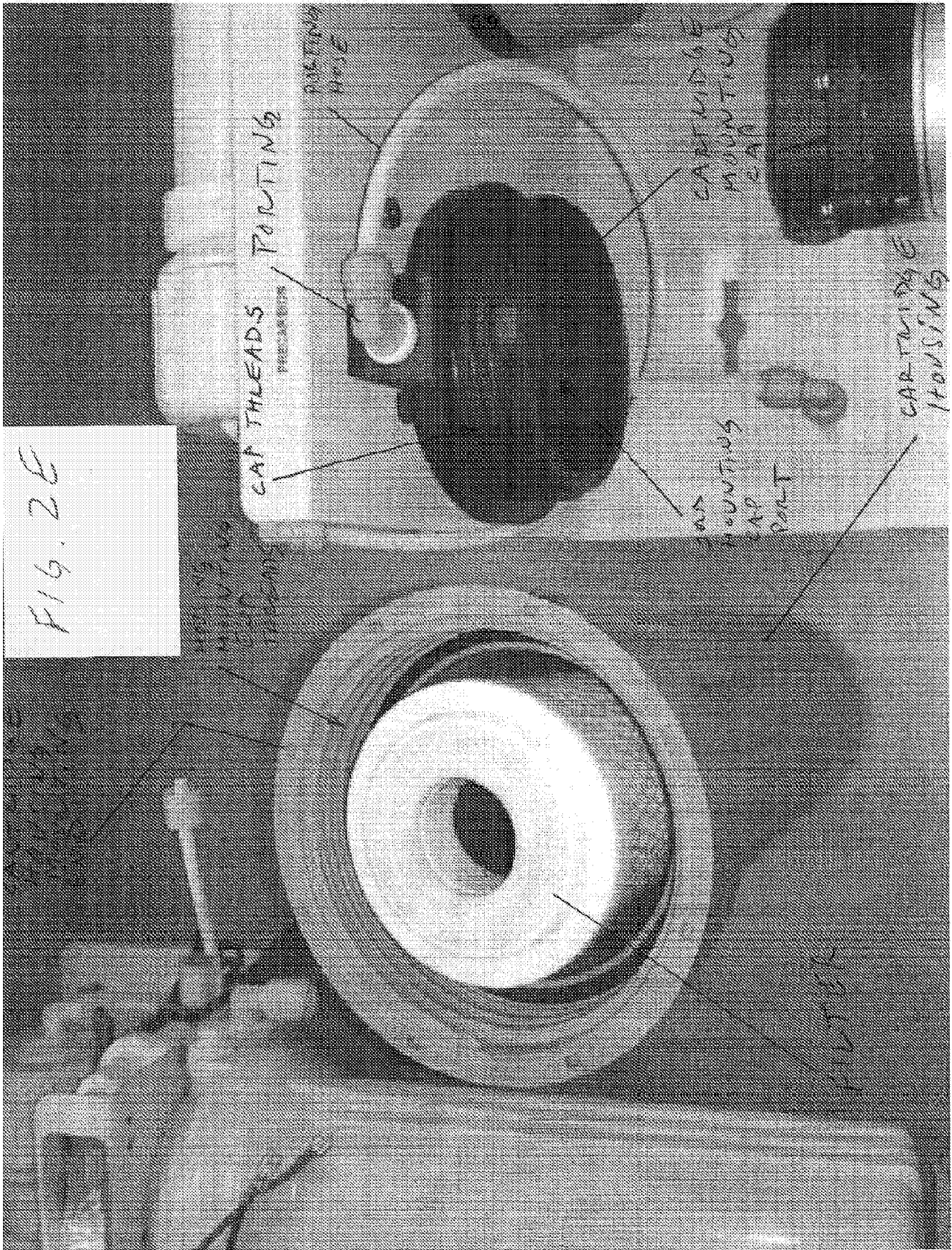
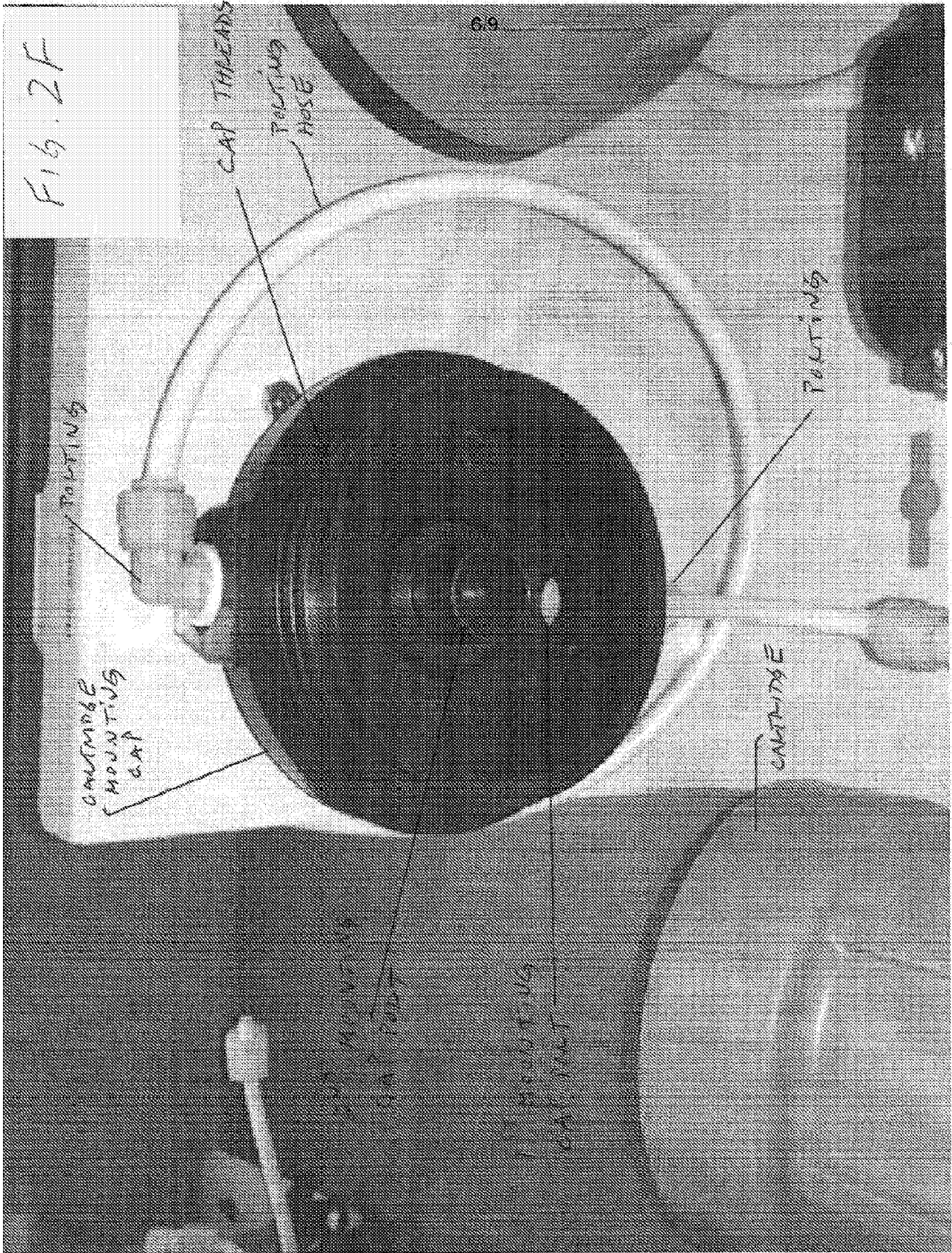


Figure 2D: Motor Pump Unit Cartridge





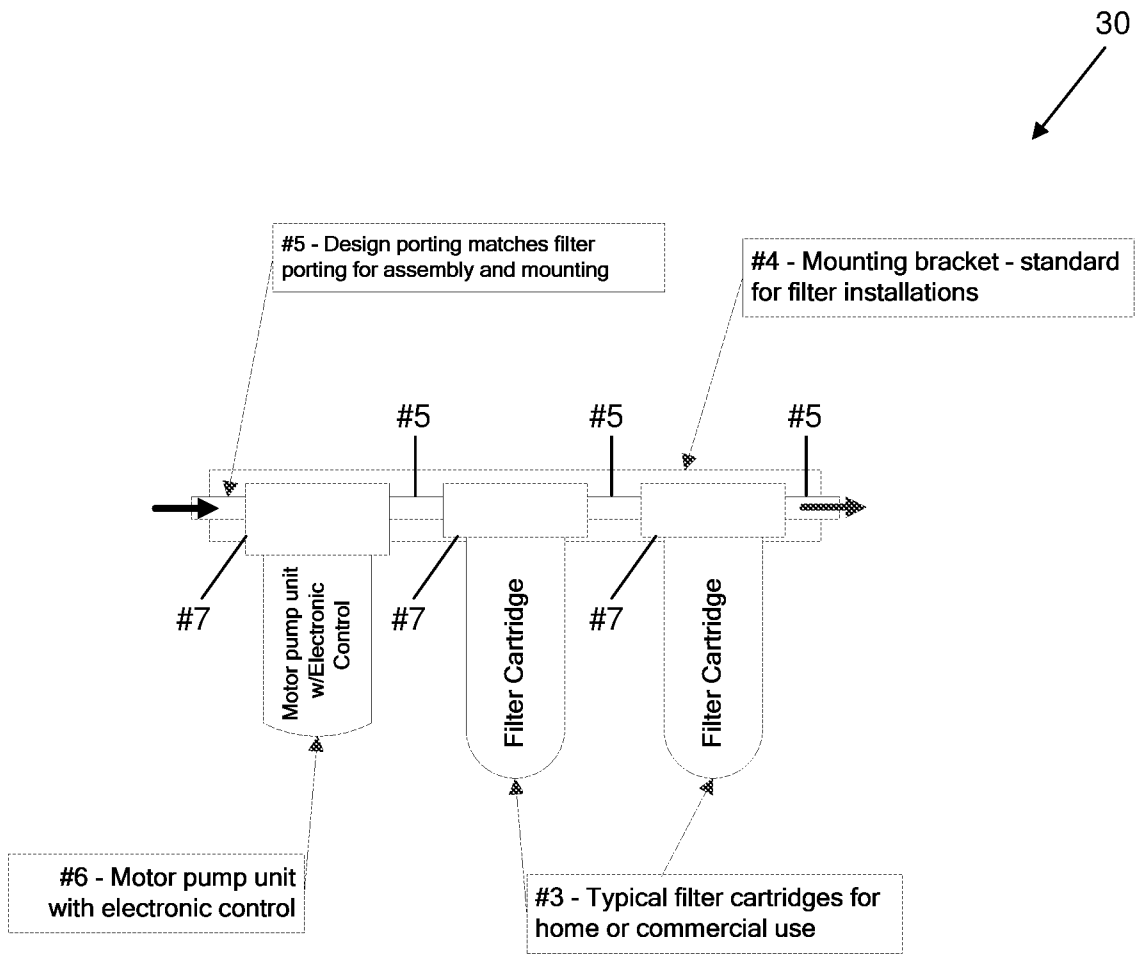


Figure 3

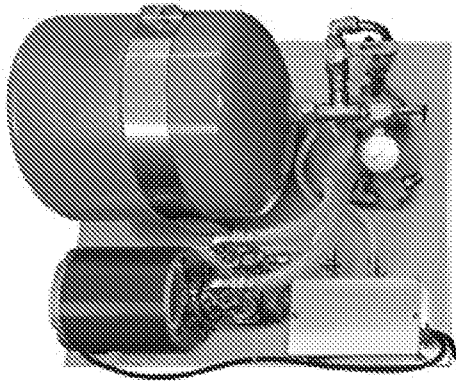


Fig. 4A

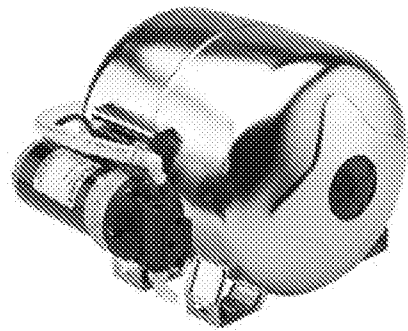


Fig. 4B

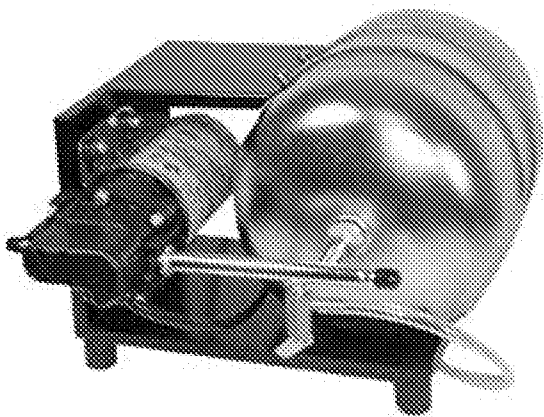


Fig. 4C

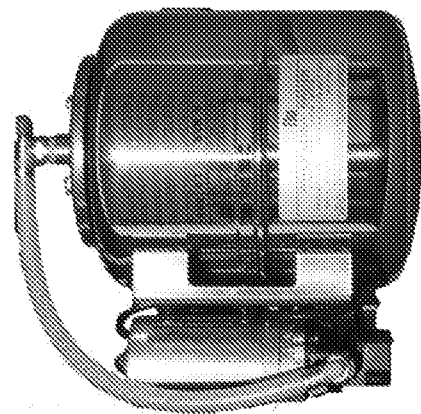


Fig. 4D

Figure 4 (Prior Art)

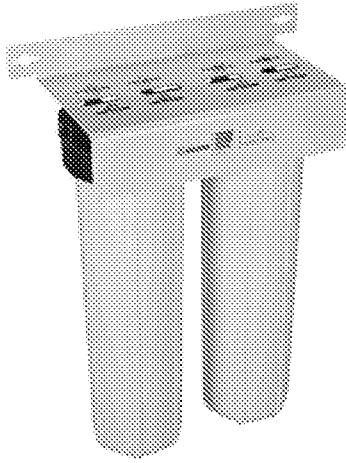


Fig. 5A

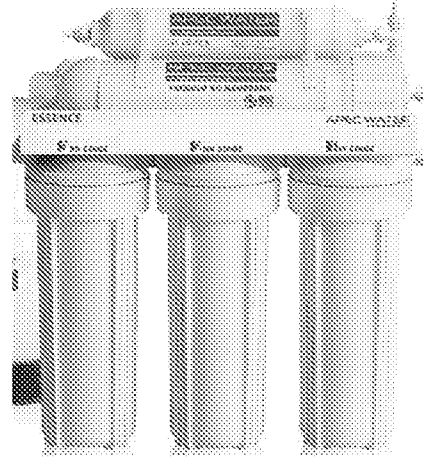


Fig. 5B



Fig. 5C

Figure 5 (Prior Art)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 16/34789

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A47J 31/40, A47J 31/44, A47J 31/46, B67D 7/76, G01F 3/36 (2016.01)
CPC - A47J 31/0642, A47J 31/40, A47J 31/407, A47J 31/446, A47J 31/46, B67D 7/76, G01F 3/36
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8)- A47J 31/40, A47J 31/44, A47J 31/46, B67D 7/76, G01F 3/36 (2016.01);
CPC- A47J 31/0642, A47J 31/40, A47J 31/407, A47J 31/446, A47J 31/46, B67D 7/76, G01F 3/36

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC- 99/295, 99/298, 99/300, 222/129.1, 222/130, 222/180, 222/189.06, 222/321.9, 222/325, 222/383.1;
Patents and NPL (classification, keyword; search terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Pub West (US EP JP WO), Pat Base (AU BE BR CA CH CN DE DK EP ES FI FR GB IN JP KR SE TH TW US WO), Google Patent, Google Scholar, Google Web, FPO; search terms: beverage, water, soda, beer, coffee, tea, carbonate, dispense, pump, pour, distribute, cartridge, pump, filter, filtration, mounting, bracket, inline, align, flow, inlet, port, adapter...

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 98/51628 A1 (SUNBEAM PRODUCTS, INC.) 19 November 1998 (19.11.1998), Figs. 11, 12, 13b, 13c; pg 2, ln 26 to pg 3, ln 18; pg 7, ln 16 to pg 8, ln 3; pg 8, ln 17 to pg 9, ln 2; pg 9, ln 19 to pg 10 ln 25; pg 12, ln 13-17	1-9
Y	US 2015/0069088 A1 (OLSON et al.) 12 March 2015 (12.03.2015), Figs. 1, 11, 12; para [0003], [0005], [0032], [0044], [0049], [0052]-[0054], [0063]	1-9
Y	US 2015/0125578 A1 (HATHERELL) 07 May 2015 (07.05.2015), para [0006]-[0342]	1-9
Y	US 6,159,383 A (GULLETT et al.) 12 December 2000 (12.12.2000), col 1, ln 59 to col 4, ln 3	1-9
Y	US 4,759,474 A (REGUNATHAN et al.) 26 July 1988 (26.07.1988), col 1, ln 40 to col 5, ln 12	1-9

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 20 August 2016 (20.08.2016)	Date of mailing of the international search report 13 SEP 2016
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Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774
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