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(72) Inventor; and
(71) Applicant : **BUTLER, Andy** [—/US]; 935 Benecia Ave, Sunnyvale, California 94085 (US).

(74) Agent: **MIGACHYOV, Larisa**; Post Office Box 2061, San Francisco, California 94126-2061 (US).

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Declarations under Rule 4.17:

— *as to the identity of the inventor (Rule 4.17(i))*

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

[Continued on next page]

(54) Title: CLOUD CONNECTED FILTRATION SYSTEM

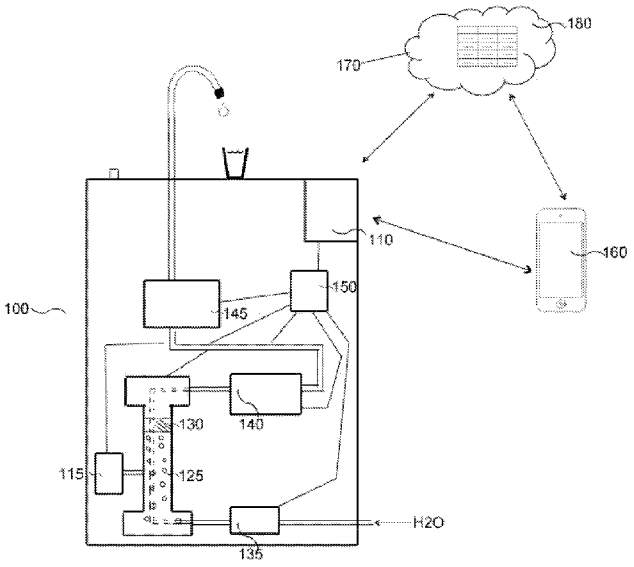


FIG 1

(57) Abstract: A water filtration system and method are provided. The water filtration device is capable of accessing a database comprising water contaminant profile data for different locations, and of adjusting its operation depending on the water contaminant profile at the location of the water filtration device. In an embodiment, the water filtration can also access user preference data by means of a mobile device carried by a user, and of adjusting its operation depending on user preference data.

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— *of inventorship (Rule 4.17(iv))*

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TITLE OF THE INVENTION

Cloud Connected Filtration System

INVENTOR

Andy Butler

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is related to and claims the benefit of U.S. Provisional Patent Application No. 61/640,736, filed May 1, 2012, which is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

The present invention generally relates to water filtration systems, and more particularly, to water filtration systems that are able to analyze and adjust to individual water contaminant profiles or user preferences.

BACKGROUND OF THE INVENTION

Water filtration devices that deploy filter status indicators are well known in the art. Such devices may display a visual indicator, sound an alarm, or simply turn off when a filter has reached the end of its useful life.

The useful life specification of a water filter is usually calculated by using a nationwide average of contaminants in municipal water. However, water quality varies dramatically from district to district, and using an average means that some users end up changing their filters too often, while others don't change their filters often enough. This leads to unnecessary expense in one case, and poor water quality in the other. Furthermore, different types of water may require different filters – some users may need a heavy-duty filter because their local water is highly contaminated, while some users require only a light-duty filter because their local water is purer.

Furthermore, different users may have different preferences or sensitivities with regard to particular contaminants in their local drinking water. A child, for example, may be much more sensitive to mercury or lead than an adult, and would require purer water. People may also have different

preferences as to the pH of their water, ionization of their water, the presence or absence of fluoride, or other parameters.

A need therefore exists for a water filtration system and method that can determine what type of water filter is needed for the particular contaminant profile in a given location, adjust the filter life expectancy accordingly, and adjust the level and type of filtration depending on an individual user's needs.

SUMMARY OF THE INVENTION

In light of the above, an object of the present invention is to provide a water filtration system and method that provides customized water filtration depending on the user's location and individual preferences.

Consistent with embodiments of the present invention, a database of water quality and contaminant profiles in different water districts is provided. The database can be located on the Internet, on a dedicated server, on the user's computer, or anywhere else that a database can be stored. A water filtration system can access the database and find the water contaminant profile at the municipality where the water filtration system is located. The water filtration system can then customize its operation depending on the particular water contaminants in the municipality where it is located.

The water contaminant profiles stored in the database can include historical data regarding past water contaminant levels, current data, and projections of future data regarding trends in water contaminant levels.

The customization can happen in several different ways. The below are some non-limiting examples. The water filtration system can change the filter life expectancy depending on the contaminant profile of the water. Also, the water filtration system can request a particular type of filter, or the user may be able to select the appropriate filter for their municipality by accessing the database. Also, the water filtration system can adjust the flow rate through the filter; a slower flow rate would ensure greater purification of the water.

In an embodiment, the system can also respond to a boil-water alert sent out by the municipality, either by notifying the user (i.e. by a visual or auditory indicator), or by automatically treating the water to render it potable. For example, the water can be disinfected by ozone generated by a UV light; the water can be boiled; chlorine or other disinfectants can be injected; or the flow rate through the filter can be slowed down.

In the preferred embodiment, a mobile device such as a smartphone is incorporated into the system. The water filtration device can communicate with the smartphone by means of a wireless connection such as Bluetooth, wi-fi, or any other wireless protocol known in the art. The smartphone can also communicate with the Internet as part of its normal operation, and can access the database, preferably by means of a special app. Finally, the smartphone is capable of identifying the user's location by means of its GPS function, and can automatically retrieve the data related to the contaminant profile at the location of the smartphone.

In an embodiment, the user can also enter preference data into the app on their smartphone; for example, the data can relate to preferred purification levels, particular sensitivities to various contaminants, taste preferences, and so on. This preference data is then transmitted to the water filtration device, which then adjusts filter life expectancy, requests a different type of filter, reroutes the water through a supplementary filter, adds substances to the water, or slows down or speeds up the flow rate through the filter in order to modify the water quality according to user preferences.

In another embodiment, the water filtration device can send data to the Internet or to the smartphone directly. For example, the water filtration device can send an alert when the filter needs to be changed; this alert can be sent directly to the smartphone or to the Internet. The server can then automatically send a text message to the user's smartphone, or an email, or any other message on any other protocol, to alert the user of the need for a filter change. Similar alerts can be sent to indicate other alert conditions – a leak in the system, a broken UV bulb, absent ozone bubbles, and so on.

In another embodiment, the system can identify individual users in the same household, and react

differently to different users. For example, different users can have different sensitivities to various contaminants in the water, or different taste preferences for their water. The system can determine which user is accessing the water by identifying the user's smartphone, by identifying an article worn or carried by the user (say, a RFID tag), or by biometrics such as face recognition, fingerprints, and so on, and customize its operation depending on which user is requesting the water.

The system can also track water usage, either by the household as a whole, or by each individual user. In one embodiment of the invention, the system can alert the user as to whether they are drinking enough water, and advise them as to how much water they need to drink for proper hydration. In another embodiment, the system can alert the household when they are using too much water, and advise them as to how to reduce their water usage to match national averages. In the preferred embodiment, the system does this by means of a smartphone app installed on the user's smartphone.

LIST OF FIGURES

Fig. 1 shows a high-level diagram of the preferred embodiment of the system.

Fig. 2 shows a flowchart of the preferred embodiment of the invention in operation.

Fig. 3 shows screenshots of the smartphone app of the preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 shows a high-level diagram of the preferred embodiment of the system of the present invention. Water filtration device 100 comprises communication module 110, controller 150, replaceable filter 130, ozonation module 125, ozone concentration module 115, flow rate modifier 135, shutoff module 140, and disinfectant module 145. The water filtration device 100 may be connected to one individual tap or to the entire household water supply. The communication module 110 can communicate with smartphone 160, directly with the cloud 170, or both. In the preferred embodiment, the communication module 110 is capable of Bluetooth communication with a smartphone or other mobile device 160 and wi-fi communication with the cloud 170. In other embodiments, only one of the two communication modes is present, or an entirely different wireless communication protocol is used in addition to, or

instead of, Bluetooth and/or wi-fi communication.

Controller 150 is connected to the communication module 110 and receives and sends data to and from the flow rate modifier 135, ozonation module 125, ozone concentration module 115, replaceable filter 130, shutoff module 140, and disinfection module 145. The controller preferably comprises a processor, memory, and software known to those skilled in the art.

Flow rate modifier 135 slows down or speeds up the water flow rate depending on purification needs. If greater purification is required, the flow rate modifier slows down the water flow so that the water spends more time in the ozonation module 125 and the replaceable filter 130. This results in more purification. The flow rate modifier can set the flow rate statically or modify it dynamically depending on which user is accessing the water, on real-time data received from the database, or on any other parameters.

Ozonation module 125 and ozone concentration module 115 disinfect and purify the water by means of ozone bubbles. The ozone concentration module 115 preferably comprises a UV light to generate the ozone. The water passes through the ozonation module 125 and then passes through the replaceable filter 130. Replaceable filter 130 can comprise a RFID tag identifying the filter, the date of installation, its useful life, and other parameters. The controller 150 can then communicate with the replaceable filter 130 to determine whether it needs to be replaced, how much of its useful life remains, or other parameters relating to the filter. The data is then passed to the communication module 110, which communicates with the cloud 170, with the user's mobile device 160, or both, to convey the information to the user.

Shutoff module 140 is capable of shutting off the water flow through the water filtration device. For example, if the municipality issues a water quality alert and the water filtration device is incapable of rendering the water potable, or some other emergency condition occurs, the controller 150 can trigger the shutoff module to shut off the water flow through the device.

Disinfection module 145 is capable of disinfecting the water in the event of a water quality alert, or for

municipalities with very contaminated water. The water may be disinfected by boiling it, injecting a disinfectant such as chlorine into the water, supplementary ozonation, supplementary filtering, or any other method of disinfection known in the art.

Database 180 is located in the cloud and comprises information regarding water contaminant profiles in at least one municipality. In the preferred embodiment, the information in the database comprises current water contaminant profiles for the water, historical water contaminant profile data, and projected future trends for water contaminant profiles. In the preferred embodiment, database 180 is located on a server that can be accessed via the Internet by the communication module 110, and can also be accessed via the Internet by the user. The database 180 preferably also contains data regarding the type of water filter that is needed for the water contaminant profile of the municipality, such that a user may access the database, enter their zip code or other location data, and find out what type of filter they need to purchase. In an embodiment, the database 180 also contains boil-water alerts put out by a municipality, so that the water filtration device, or the user, can access the data regarding such alerts. The database data may come from the municipality, from independent water analysis, or from a contaminant analysis module in the water filtration device itself.

Smartphone 160 is able to communicate with the database 180 by means of its built-in Internet connection (either via wi-fi, cellular data, or any other method of accessing the Internet).

In an embodiment, smartphone 160 is also able to communicate with the water filtration device 100. The communication may happen via Bluetooth, wi-fi, or any other wireless communication protocol. The water filtration device 100 may send data to the smartphone 160 regarding alert conditions such as a need to replace the filter, a broken UV bulb or malfunctioning disinfection module (i.e. no ozone bubbles), a leak, and so on. The smartphone receives that data and alerts the user of the alert condition. In an alternate embodiment, the communication module 110 sends data to the Internet regarding the alert condition and the alert is then sent to the user's smartphone.

In the preferred embodiment, smartphone 160 has an app installed that can communicate with the

database 180 and with the water filtration device 100. The app enables the smartphone to determine the water contaminant profile at the smartphone location, allows the user to enter water filtration preferences, and identifies the user to the water filtration device. The app also performs other functions, as is described below.

In the preferred embodiment, the water filtration device 100 comprises only one replaceable filter 130. The replaceable filter 130 may come in several different types to accommodate different contaminant profiles. The user selects the appropriate type of filter by accessing the database directly via the Internet or by having their smartphone or the water filtration device inform them of what type of filter they need to purchase for the water at their location.

In an embodiment, the system retains the information on the store where it was purchased. The user can then automatically be rerouted to the online shopping page of the same store when they need to purchase filters.

In an alternate embodiment (not shown), the water filtration device 100 comprises at least two replaceable filters. The water may be rerouted through different individual filters depending on user preferences and needs, or may be rerouted through at least two filters in series.

Fig. 2 shows a flowchart of the water purification method of the present invention. First, the user's smartphone establishes the user's location 200. This can be done automatically by the smartphone, or manually entered by the user. The smartphone then contacts the database 210 to determine the water contaminant profile at the user's location, and transmits the water contaminant profile to the water filtration device 220. The smartphone may perform these steps by means of its wi-fi connection, a cellular data connection, a Bluetooth connection (for communicating with the water filtration device), or any combination of the above.

The water filtration device then adjusts its operation 230 in response to the water contaminant profile. A few non-limiting examples are listed below. For example, it may adjust the filter life expectancy depending on the water contaminant levels; heavier contaminant levels would then mean that the filter

would need to be changed more often. It may indicate the type of filter it requires, or the number of filters or the type of supplementary filter it requires. It may change the flow rate through the filter – a slower flow rate means that the filter would purify the water better, while a faster flow rate would mean less purification. It may shut off the water flow altogether. Other ways of adjusting the operation of the water filtration device may also be apparent to those skilled in the art.

In the preferred embodiment, the user can also enter preference data into their smartphone 240. The preference data is then transmitted to the water filtration device 250. The water filtration device then adjusts its operation based on user preference data as well as, or instead of, the local water contaminant profile.

Fig. 3 shows some screenshots of the smartphone app that is a part of the preferred embodiment of the present invention. Screenshots 300 provide a welcome and login / create account screen to allow the user to log in to the app or to create an account. The user can edit their personal profile by entering their age, weight, and location (or allow the smartphone to determine the location automatically). The user can link a filter unit to the app via the "Add new zuvo unit" screen 310, and manage several different water filtration units via the "Manage Units and Filters" screens 320. The app offers a filter guide screen 330 and allows the user to enter filter details via the "Add filter info" screen 340.

The main screen of the app is shown in screenshot 350. It shows the days remaining on the filter, water quality data in the area, and daily water consumption and water consumption goals for the user. By clicking on the water quality data button, the user can access a more detailed summary of water quality data in their area 360 as well as any boil-water alerts issued by their water district. The user can also access a contaminant detail screen 370 for more detailed descriptions of any contaminants they want to learn more about.

Tapping on the filter icon on the main screen 350 takes the user to a purchase filter screen 360. The user may select the appropriate filter for their type of water and purchase it online.

By tapping on the water consumption button on the main screen 350, the user is taken to their

"hydration coach" screen 370. The user is then able to see their weekly water consumption, edit their personal profile (age, weight, and so on), and see their daily goal for water consumption.

The above written description uses examples to disclose the invention and the preferred embodiment thereof, and is intended to enable any person skilled in the art to make and use the invention. The patentable scope of the invention is defined by the claims, and may include other examples and embodiments that occur to those skilled in the art. Such other examples and embodiments are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

CLAIMS

1. A water filtration system, comprising:

   a water filtration device;

   a replaceable water filter;

   a database comprising information about water contaminant profiles at various locations;

   said water filtration device capable of communication with the database and of customizing its operation depending on data received from the database.

2. A water filtration system, comprising:

   a water filtration device;

   a replaceable water filter;

   a database comprising information about water contaminant profiles at various locations;

   a mobile device capable of communication with the database and with the water filtration device, said water filtration device capable of customizing its operation depending on data received from the mobile device.

3. The water filtration system of Claim 1, where the database is accessible via the Internet.

4. The water filtration system of Claim 2, where the mobile device is one of the following group: a smartphone, a tablet, a computer.

5. The water filtration system of Claim 2, where the mobile device comprises an application configured to determine the location of the water filtration device and compare the location to information stored in the database.

6. The water filtration system of Claim 2, where the data received from the mobile device comprises the water contaminant profile at the location of the mobile device.

7. The water filtration system of Claim 6, where the data received from the mobile device further comprises user preferences relating to water filtration.

8. The water filtration system of Claim 1, where the replaceable filter comprises an electronic tag

readable by the water filtration device.

9. The water filtration system of Claim 1, where the water filtration device is capable of adjusting filter life expectancy depending on data received from the database.
10. The water filtration system of Claim 1, where the water filtration device is capable of indicating which type of filter it requires depending on data received from the database.
11. The water filtration system of Claim 1, where the water filtration device is capable of rendering water potable if the data received from the database comprises a water quality alert.
12. The water filtration system of Claim 1, where the water filtration device shuts down water flow if the data received from the database comprises a water quality alert.
13. The water filtration system of Claim 1, where the database can be accessed by a user.
14. The water filtration system of Claim 13, where a user can determine what type of filter is required for a particular location by accessing the database.
15. The water filtration system of Claim 13, where a user can preferentially select a type of filter based on user preferences and location by accessing the database.
16. The water filtration system of Claim 2, where the water filtration device is capable of sending data to the mobile device.
17. The water filtration system of Claim 1, where the water filtration device is capable of sending data to the database.
18. The water filtration system of Claim 17, where the data includes the seller of the water filtration system.
19. The water filtration system of Claim 18, where a user is directed to purchase filters from the seller of the filtration system by accessing the database.
20. The water filtration system of Claim 17, where the data comprises at least one of the following group: system diagnostics, filter life expectancy, flow rate through the filter, need for filter replacement, leak alert, ozone bubbles absent, UV bulb broken.

21. A method of purifying water, comprising:

storing information regarding water contaminant profiles at various locations in a database;

determining the location of a water filtration device;

determining the local water contaminant profile at the location of the water filtration device by accessing the database;

using the local water contaminant profile to customize the operation of the water filtration device.

22. A method of purifying water, comprising:

storing information regarding water contaminant profiles at various locations in a database;

accessing the database with a mobile device;

determining the location of the mobile device;

determining the local water contaminant profile at the location of the mobile device;

using the local water contaminant profile to customize the operation of a water filtration device.

23. The method of Claim 21, where information regarding water contaminant profiles at various locations comprises historical data regarding water contaminant profiles in the past.

24. The method of Claim 21, where information regarding water contaminant profiles comprises data acquired by a contaminant analyzer module in the water filtration device.

25. The method of Claim 21, where information regarding water contaminant profiles at various locations comprises future projected data regarding water contaminant profiles in the future.

26. The method of Claim 22, further comprising:

accessing a water filtration device with a mobile device;

receiving data from the water filtration device;

using the data along with the local water contaminant profile to customize the operation of a water filtration device.

27. The method of Claim 22, further comprising:

entering user preference data into a mobile device;

transmitting the user preference data to the water filtration device;

using the user preference data along with the local water contaminant profile to customize the operation of the water filtration device.

28. The method of Claim 22, further comprising:

accessing the database with a mobile device to determine whether there is a water quality alert at the location of the mobile device;

transmitting data regarding any water quality alerts to the water filtration device;

triggering the water filtration device to indicate the existence of a water quality alert.

29. The method of Claim 28, further comprising treating the water to render it suitable for human consumption.

30. The method of Claim 28, further comprising preventing the flow of water through the water filtration system.

31. The method of Claim 28, where treating the water comprises at least one of the following steps: slowing down the flow rate, increasing ozone content of the water, increasing UV irradiation of the water, injecting a disinfectant into the water, or boiling the water.

32. The method of Claim 21, where customizing the operation of a water filtration device comprises adjusting the filter life expectancy.

33. The method of Claim 21, where customizing the operation of a water filtration device comprises determining the type of filter to be used.

34. The method of Claim 21, where customizing the operation of a water filtration device comprises rerouting the water through at least one supplementary filter.

35. The method of Claim 21, where customizing the operation of a water filtration device comprises shutting off the water flow through the water filtration device.

36. The method of Claim 22, where the mobile device is a smartphone.

37. The method of Claim 21, where the database is stored on the Internet.

38. The method of Claim 22, where determining the location of the mobile device is done automatically by the mobile device.

39. The method of Claim 22, where determining the location of the mobile device is done by user input.

40. The method of Claim 22, further comprising tracking water usage data.

41. The method of Claim 22, further comprising:

identifying a user of the water filtration device.

42. The method of Claim 41, further comprising:

customizing the operation of the water filtration device based on the user's preferences.

43. The method of Claim 41, further comprising:

tracking water usage data for the user.

44. The method of Claim 41, further comprising:

determining a recommended water intake for the user;

giving the user feedback on their water usage.

45. The method of Claim 41, further comprising:

giving the user feedback on their water usage.

46. The method of Claim 41, where identifying the user is performed by identifying the mobile device carried by the user.

47. The method of Claim 41, where identifying the user is performed by identifying an electronic wearable device worn by the user.

48. The method of Claim 41, where identifying the user is performed by biometric analysis.

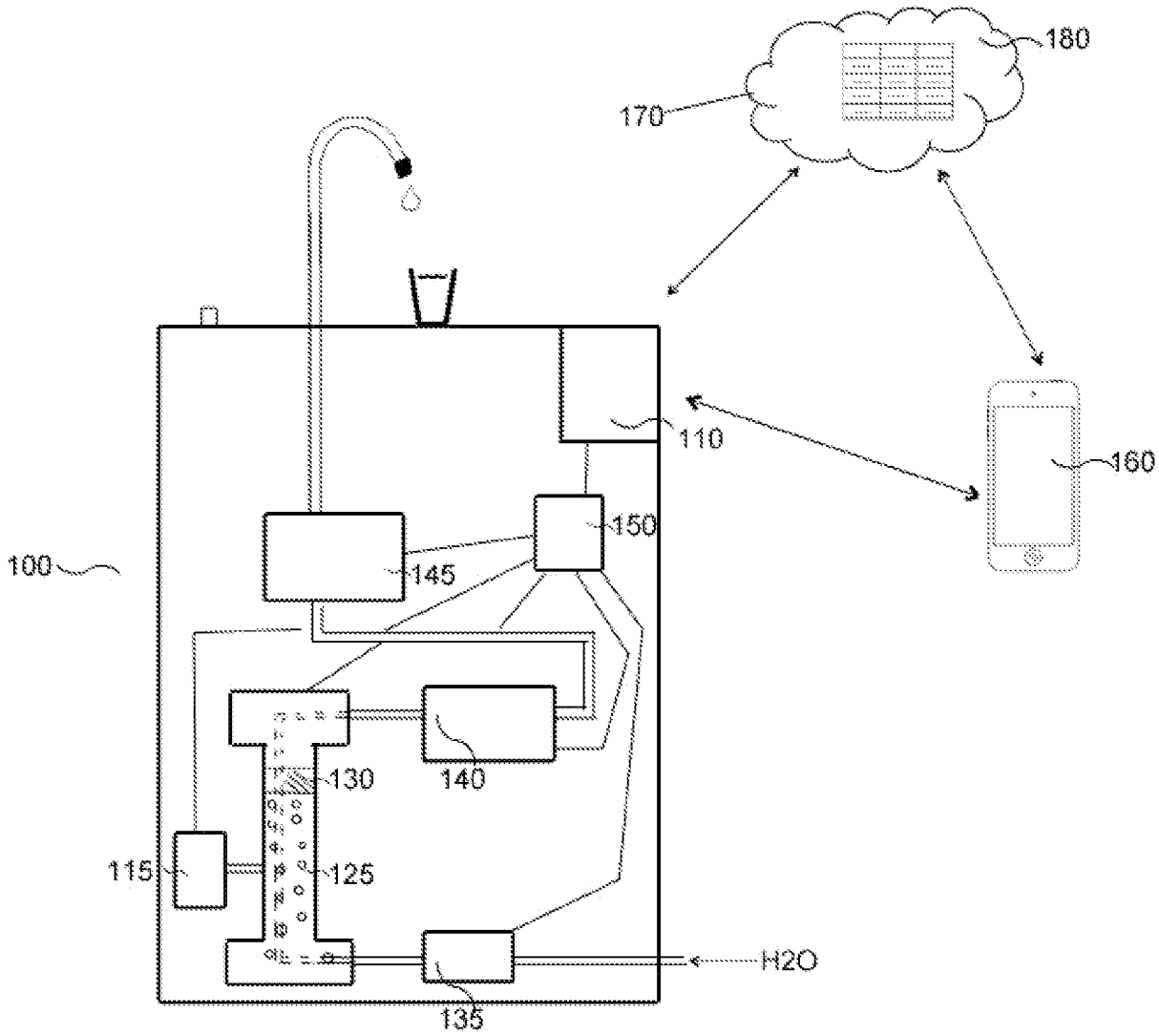


FIG 1

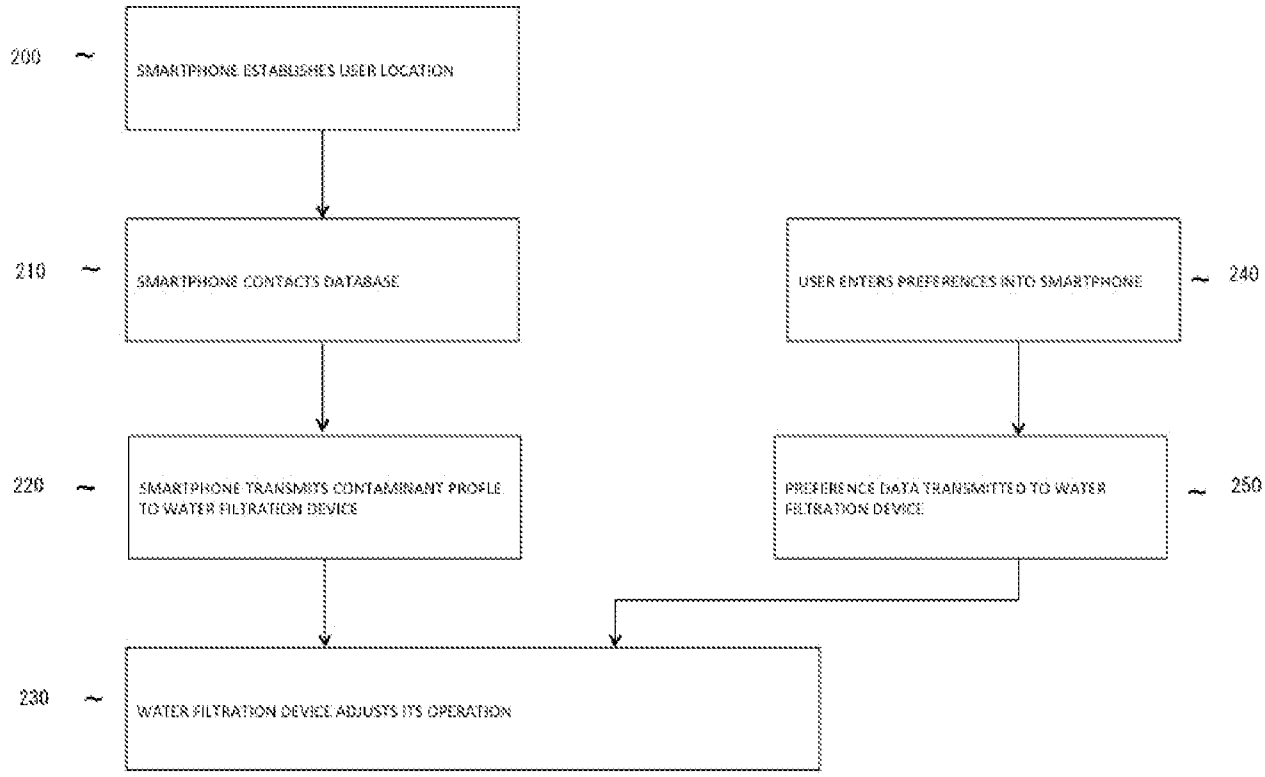
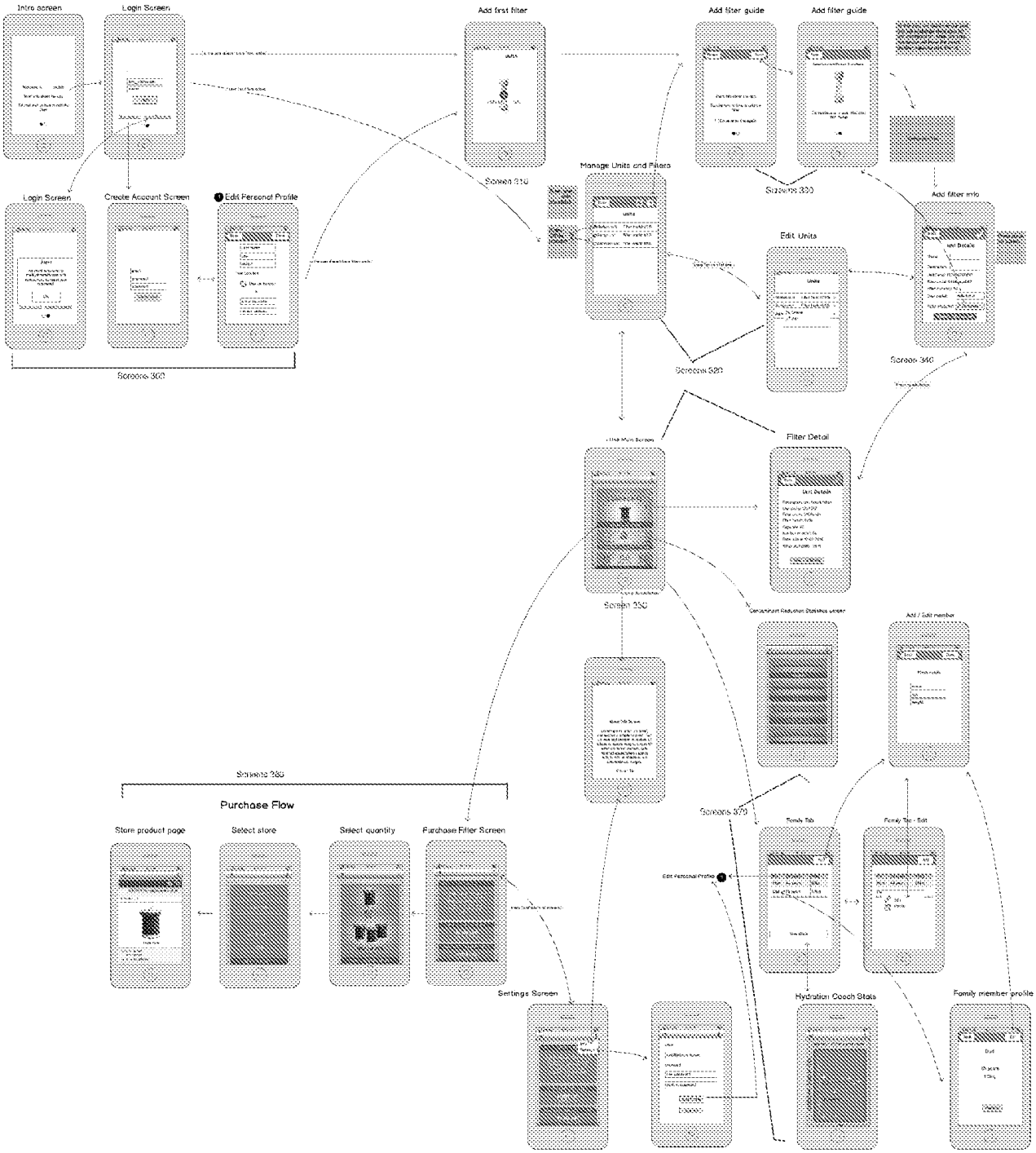

200
SMARTPHONE ESTABLISHES USER LOCATION
210
SMARTPHONE CONTACTS DATABASE
220
SMARTPHONE TRANSMITS CONTAMINANT PROFILE TO WATER FILTRATION DEVICE
230
WATER FILTRATION DEVICE ADJUSTS ITS OPERATION
240
USER ENTERS PREFERENCES INTO SMARTPHONE
250
PREFERENCE DATA TRANSMITTED TO WATER FILTRATION DEVICE

FIG 2

FIG. 3


Intro screen
Login Screen
Add first filter
Add filter guide
Add filter guide
Screen 310
Screens 330
Login Screen
Create Account Screen
Edit Personal Profile
Manage Units and Filters
Add filter info
Edit Units
Screens 300
Screen 320
Screen 340
Filter Detail
Screen 350
Screens 380
Purchase Flow
Store product page
Select store
Select quantity
Purchase Filter Screen
Screens 370
Settings Screen
Hydration Coach Stats
Family member profile

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/038944

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - C02F 1/00 (2013.01)
USPC - 210/650
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) - C02F1/00, 1/42, 1/44, 9/00 (2013.01)
USPC - 210/600, 650, 652

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - C02F1/00, 1/42, 1/44; C02F 9/00 (2013.01)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Orbit, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2010/0332149 A1 (SCHOLPP) 30 December 2010 (30.12.2010) entire document	1, 3, 9, 11-13, 17, 20, 21, 23-25, 32, 35, 37 --- 2, 4-8, 10, 14-16, 18, 19, 22, 26-31, 33-34, 36, 38-48
Y	MUEHLICH, Mobile State of the Environment Reporting providing environmental information via smartphone by the example of water quality, Master's Thesis, 01.01.2011. Retrieved from the internet. Retrieved on [18.09.2013] <URL: uba-mobile.googlecode.com/svn-history/r119/trunk/documentation/LaTeX/thesis_all.pdf> entire document	2, 4-7, 16, 22, 26-31, 36, 38-48
Y	US 2012/0000858 A1 (BUTLER et al) 05 January 2012 (05.01.2012) entire dcoument	8
Y	EATON, "Eaton eFiltration", Overview of app, 14.09.2011. Retrieved from the internet. Retrieved on [18.09.2013] <URL: http://appsq.com/app/6oi9/eaton-efiltration> entire document	10,14,15,18,19,33
Y	E P 0 899 237 A2 (GRIFFITHS et al) 03 March 1999 (03.03.1999) entire document	34
Y	US 2011/0024456 A1 (RINKER et al) 03 February 2011 (03.02.2011) entire document	40,43-48

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 September 2013	30 SEP 2013
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