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(54) Title: BASEMENT SUMP CONTROL SYSTEMS AND METHODS

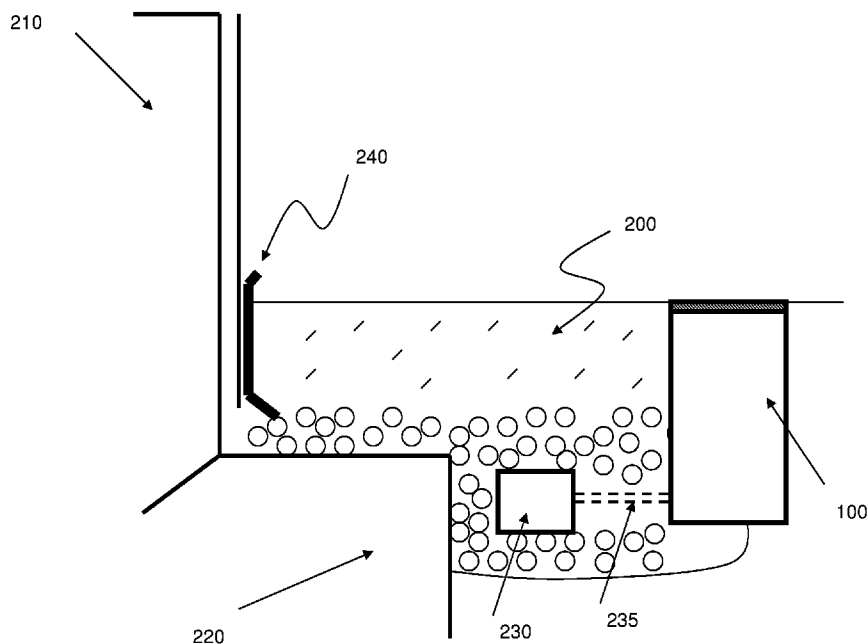


FIG. 1

(57) **Abrégé/Abstract:**

Basement sump control systems are disclosed. A controller may monitor an operational parameter of a sump pump, for example, a sump water level. The controller may override a switch associated with the sump pump to maintain operation of the sump pump in response to the monitored operational parameter registering an abnormal condition, for example, a high water level.



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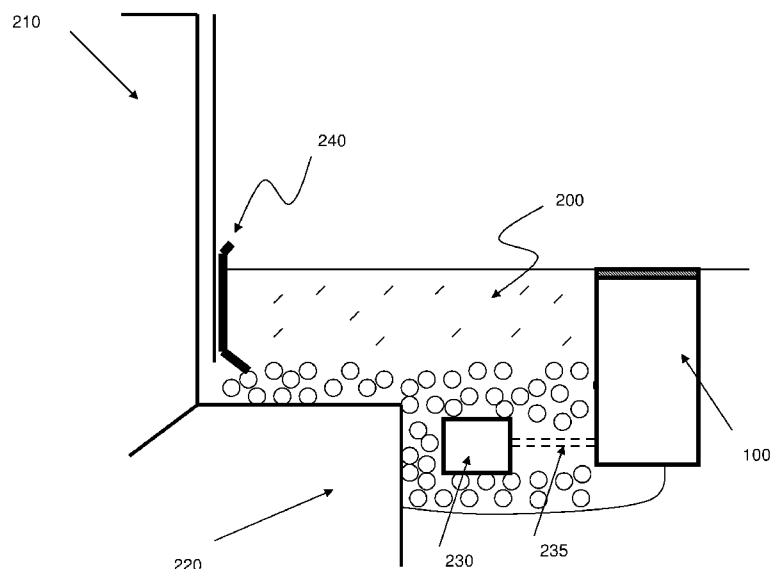


FIG. 1

(57) Abstract: Basement sump control systems are disclosed. A controller may monitor an operational parameter of a sump pump, for example, a sump water level. The controller may override a switch associated with the sump pump to maintain operation of the sump pump in response to the monitored operational parameter registering an abnormal condition, for example, a high water level.

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BASEMENT SUMP CONTROL SYSTEMS AND METHODS

FIELD OF THE INVENTION

At least one embodiment of the present invention relates generally to devices and
5 methods for basement waterproofing and, more particularly, to basement sump control systems
and methods for use in waterproofing.

BACKGROUND

The potential for moisture in the basement of buildings is of ongoing concern to
10 homeowners, building contractors, and structural engineers. Basement foundation footings are
typically located several feet below ground level, and water may accumulate around the
foundation as the groundwater level periodically rises, for example, due to rain or melting snow.
As a result, hydrostatic pressure may build causing leakage at cracks in the footings, structural
interfaces, and through the floor. Concrete, typically used in the construction of foundations,
15 attracts groundwater by sorption, and capillary forces in the concrete pores facilitate further
penetration of the groundwater. Seepage of groundwater into a basement can cause significant
structural damage, as well as promote the growth of harmful bacteria, such as iron bacteria.
Furthermore, dangerous radon gas, and water vapors contributing to a high basement humidity
level, can flow easily through the concrete pores.

20 Interior, sub-floor drainage systems have been developed to address problems with
moisture in basements. Such systems typically include a drainage conduit installed along the
interior perimeter of the basement, positioned below the basement floor and in close proximity to
the foundation wall. The drainage conduit serves to collect and convey groundwater to a
basement sump for extraction.

25 In general, the sump is a sub-floor water collection zone positioned at the lowest point of
the basement, often in a corner, so that groundwater naturally drains towards it. Within a sump
hole, a sump pump is typically housed in a sump liner to discharge groundwater.

SUMMARY

30 In accordance with one or more aspects, a basement sump control system may comprise a
sump pump, and a controller in communication with the sump pump. The controller may be

configured to monitor an operational parameter of the sump pump, and override a switch associated with the sump pump to maintain operation of the sump pump in response to the monitored operational parameter registering an abnormal condition.

Other advantages, features, and objects of the invention will become apparent from the following detailed description when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are not intended to be drawn to scale. In the drawings, each identical or nearly identical component that is illustrated in various figures is represented by like numeral. For purposes of clarity, not every component may be labeled in every drawing. Preferred, non-limiting embodiments of the present invention will be described with reference to the accompanying drawings, in which:

FIG. 1 illustrates a sump system installed as part of a basement waterproofing system in accordance with one or more embodiments; and

FIG. 2 illustrates a sump control system installed as part of a basement waterproofing system in accordance with one or more embodiments.

DETAILED DESCRIPTION

In accordance with one or more embodiments, the present invention relates generally to an improved basement sump system for use in basement waterproofing. The sump system may be effective in collecting and discharging groundwater to a remote location in order to prevent penetration of the basement structure. The sump system may be installed within a sump hole in various foundation configurations, typically in close proximity to a foundation wall such as in a corner of a basement or along a straight wall. The sump system may be installed generally so as to promote the flow of groundwater towards the sump system, for example, at the lowest point in a basement floor.

In accordance with one or more embodiments, disclosed systems and methods may provide protection against moisture, mold, mildew, water, basement flooding, and poor air quality. Basements and basement waterproofing systems may be monitored and controlled to protect against flooding due to sump pump failures. Sump pump system dependability may be improved. The function and/or status of sump pump systems may be monitored and/or

controlled. Basement conditions may also be monitored and/or controlled. Various parameters may be monitored, problems may be detected, and related feedback may be relayed. Corrective and/or preventative action may be taken. In some embodiments, high water level detection and alerts may be provided. In other embodiments, sump pump system self-diagnostics may be provided. In at least some embodiments, sump pump control override may be provided. Battery backup status may be provided. Beneficially, the system may be configured to communicate wirelessly over the Internet, and electronic alerts, i.e. e-mail, may be provided. The system may be further configured to continuously operate in the background and may provide for safeguarding regardless of whether or not a dwelling is occupied.

In accordance with one or more embodiments, a level sensor may detect high water, sound an audible alarm, and/or send a notification indicating that there is a problem. When high water level occurs, the system may be overridden allowing the sump pump(s) to run independently until the high water level is corrected and/or the sump pump system is repaired. A notification may be provided indicating that there is a problem and that the system has been overridden. Self-diagnostics may be continuous or periodic and issues may be reported. In addition to water level, monitored parameters may include the sump pump(s) being powered on and exercised to verify proper operation. Sump pump life expectancy may be measured, calculated, and reported. Backup batteries may be tested to confirm proper voltage and power. System power and communication capabilities may be verified. A mobile interface may be provided. Alerts may be sent to one or more pre-selected users including owners, occupants, and/or service providers. The disclosed systems and methods may be particularly desirable, for example, in connection with second homes and/or rental properties in order to safeguard and protect real estate investments.

This invention is not limited in its application to the details of construction and the arrangement of components as set forth in the following description or illustrated in the drawings. The invention is capable of embodiments and of being practiced or carried out in various ways beyond those exemplarily presented herein.

FIG. 1 illustrates a sump system 100 in accordance with one or more embodiments of the present invention positioned in a basement having a basement floor 200, a foundation wall 210 and a foundation footing 220. The sump system 100 may be installed as part of a basement waterproofing system which may, for example, include a drainage conduit 230 disposed along a

perimeter of the basement to collect, channel and convey groundwater. The drainage conduit 230 may be fluidly connected to the sump system 100, such as by a conduit port 235, to facilitate collection and discharge of groundwater from the basement. The conduit 230 may be implemented using a conduit as described in U.S. Patent No. 7,954,280 to Andras which is hereby incorporated herein by reference in its entirety for all purposes. The waterproofing system may further include a flange 240 to aid in directing groundwater to the drainage conduit 230. In one embodiment, the flange 240 may be implemented using a flange as described in U.S. Patent No. 8,596 002 to Andras which is also hereby incorporated herein by reference in its entirety for all purposes.

In accordance with one or more embodiments, the sump system may generally include a sump pump housed within a sump liner. Typical sump pumps commonly known to those in the art may be implemented in the present invention, for example, a pedestal or submersible sump pump. The sump pump is often an electric or water-powered device capable of delivering accumulated water from the interior of the sump liner to outside the building structure via associated discharge piping. For example, the sump pump may remove collected ground water to a remote dry well or storm drain. In some embodiments, the discharge piping may comprise one and one-half inch polyvinyl chloride (PVC) plastic piping. The sump pump typically has a float-activated switch to automatically maintain a fluid within the sump liner below a predetermined level, for example, about 10 inches. The vertical position of the sump pump relative to the sump liner may, in part, dictate a threshold fluid level within the sump liner for pump activation. In some embodiments, the sump system may also contain a backup sump pump, sometimes battery powered, in addition to a primary sump pump for further protection. In some embodiments, the sump liner may be as described in U.S. Patent No. 7,788,877 to Andras which is also hereby incorporated herein by reference in its entirety for all purposes.

In accordance with one or more embodiments, a basement sump control system may include a sump pump and a controller in communication with the sump pump. The controller may be positioned proximate to or distant from the sump pump. In some non-limiting embodiments, the controller may be positioned in the sump along with the sump pump. In other embodiments, the controller may be positioned remotely. The controller may be configured to monitor an operational parameter of the sump pump. The controller may be further configured to override a switch associated with the sump pump, i.e. a float-activated switch, to maintain

operation of the sump pump in response to the monitored operational parameter registering an abnormal condition. The controller may therefore be configured to send a control signal to the sump pump for actuation thereof.

5 In some embodiments, the controller may be connected to a source of alternating current (AC) power. In at least some embodiments, the system may further comprise a backup battery for the controller. The sump pump may likewise be connected to a source of AC power and/or backup battery.

10 In accordance with one or more embodiments, the system may include one or more sensors. For example, the system may include at least one water level sensor. Temperature and/or humidity sensors may also be included in the system. The controller may be in communication with one or more of the various sensors. For example, the controller may be in communication with first and/or second water level sensors. The controller may be configured to process data from the sensor and to generate a related control signal as described herein.

15 In accordance with one or more embodiments, the operational parameter may be monitored periodically. In other embodiments, the operational parameter may be monitored continuously. Various operational parameters may be monitored by the controller. In some embodiments, a sump water level may be monitored. In this regard, the abnormal condition to be monitored for may pertain to a high sump water level. A predetermined water level may constitute a high water level threshold. Placement of the sensor may be related to the
20 predetermined water level threshold value. A high water level may be indicative of sump pump malfunction. In response to detecting a high water level, the controller may override the sump pump switch to actuate the sump pump. In this way, water damage may be prevented until proper sump pump operation can be resumed.

25 In some embodiments, a monitored operational parameter may pertain to an on/off status or transient, surge, or average current draw of the sump pump. The monitored operational parameter may pertain to a sump pump's total hours or total cycles of operation.

In some embodiments, the controller may be further configured to determine a life expectancy of the sump pump. For example, by monitoring its voltage and/or amperage, the life expectancy may be predicted in that a sump pump will tend to use more energy as it ages
30 towards failure.

In accordance with one or more embodiments, the controller may be configured to perform a diagnostic test. The diagnostic test may be performed periodically or continuously. For example, the diagnostic test may be performed weekly. The diagnostic test may relate to the controller's functioning and/or communication capability. The diagnostic test may involve an exercise of the sump pump. The diagnostic test may pertain to evaluating power to the controller and/or sump pump, i.e. the AC system power and/or backup battery may be monitored. The controller may report various results associated with the diagnostic test. For example, the controller may provide an indication of battery status and/or battery voltage.

Any one, two, three, or more of the above-mentioned functions can be performed by the controller, either continuously or periodically.

In accordance with one or more embodiments, the controller may be connected to a local area network (LAN). The controller may be configured to operate over a wireless network. The controller may generally be configured to communicate regarding the status of at least one system component or operational parameter. For example, the controller may output a notification in response to registering an abnormal condition, i.e. a high water level or a power issue. The controller may also output a notification in response to overriding the sump pump switch. The notification may be provided electronically. The notification may be communicated to a smart phone, tablet, or web page interface. The notification may be directed to a property owner or tenant. The notification might be directed to a maintenance technician.

In accordance with one or more embodiments, the system may include an alarm, i.e. an audible or visual alarm. The controller may be configured to generate an alarm signal in response to detecting an abnormal condition. For example, the controller may be configured to generate an alarm signal in response to detecting a high water level or low power level.

In accordance with one or more embodiments, the controller may include various additional features. For example, the controller may include a reset feature. In other embodiments, the controller may include a silence feature.

As noted above, the system may include at least one temperature sensor in communication with the controller. A temperature sensor may be configured to monitor an internal basement temperature. A temperature sensor may be configured to monitor an external environmental temperature. The controller may be configured to actuate a fan, for example, responsive to the temperature sensor.

As further noted above, the system may include at least one humidity sensor in communication with the controller. A monitored humidity level may relate to an inside humidity condition, an outside humidity condition, or both. The controller may be configured to actuate a fan or vent responsive to the humidity sensor.

5 In accordance with one or more embodiments, the system may include a basement fan, a basement vent, and/or a basement dehumidifier, each of which may be in communication with the controller which, in turn, may be in communication with relevant associated sensors. The controller may be configured to monitor an operational condition of one or more of any fan, vent, and dehumidifier. For example, a basement fan's total hours or total cycles of operation may be
10 monitored and reported.

Beneficially, the controller may be configured to operate one or more system components, e.g. a basement fan and/or vent, in order to maintain air quality. Humidity levels may also likewise be controlled. It may generally be considered desirable to refresh and/or circulate air in the basement environment continuously or periodically. The controller may be
15 configured to actuate a basement fan or vent to exhaust air if an outside humidity level is below a threshold level, e.g. about 50% or less. The controller may be further configured to actuate the basement fan to refresh air regardless of an outside humidity level. For example, in some non-limiting embodiments, a fan or vent may be actuated for a period of a few hours, e.g. one, two, three, four, five or more hours if the humidity level has been above a threshold level, e.g. about
20 50% or more for a predetermined period of time, i.e. 72 hours. In this way, proper circulation can be ensured.

With reference to FIG. 2, a sump control system and related methods are disclosed. Controller 250 may be in communication with sump pump 260. Controller 250 may include sensors, e.g. inside humidity and/or temperature sensors. Controller 250 may also be in
25 communication with various external sensors, e.g. outside humidity and/or temperature sensors. Controller 250 may be in communication with one or more level sensors 270. In response to level sensor 270 detecting an abnormal condition, i.e. a high water level, controller 250 may send an actuation control signal to sump pump 260. The actuation control signal may override a switch of the sump pump 260. The override may continue until a service call can be placed.
30 Controller 250 may be provided with AC and/or DC power. The system may also include a backup battery. Controller 250 may also be in communication with a basement fan as described

herein. Controller 250 may have an alarm, such as may involve a speaker. The overall system may include one, two, or more sump pumps and associated level sensors as illustrated. The controller 250 may be configured to transmit reports, alerts, and/or communications, e.g. via e-mail notifications. These may be provided over the internet, such as via a wireless network.

5 Data can be transmitted to a smart phone, tablet, or web page interface. In addition to monitoring for high water levels, various system diagnostics may be run and reported periodically or continuously as described herein. Battery backup status, sump pump life expectancy, sump pump on/off status, sump pump current draw, sump pump total hours or cycles, fan total hours or cycles, battery voltage may all be monitored and reported. Related
10 alerts and/or alarms may be provided as desired. Beneficially, the system is generally failsafe and can operate without power to the controller.

In accordance with one or more embodiments, the system may include a second sump pump, wherein the controller is in communication with both sump pumps. While backup sump pumps have been described as accompanying a primary sump pump in a single sump liner, it is
15 also envisioned that two or more sump systems may function in a network. For example, two or more sump liners may be installed in close proximity and may be fluidly connected to each other. In some embodiments, a sump pump housed in one sump liner may serve as a backup for a sump pump positioned in another sump liner.

A sump kit may be provided for assembly of a sump control system in accordance with
20 one or more embodiments. For example, the sump kit may include a sump liner and one or more sump pumps. Various sensors may be provided. A controller as described herein can be provided. A mobile interface can be provided. Instructions for installation and/or use may be provided. Associated discharge piping may be provided. Optionally, a backup sump pump may also be provided to impart additional protection.

25 Existing sump systems may be retrofitted in accordance with one or more embodiments. For example, a controller and one or more sensors may be put into communication with an existing sump pump. Alternatively, a new sump pump, controller, and/or sensors may be introduced to an existing sump liner. Additional components, for example a drainage conduit, may also be installed as part of a retrofit application.

30 Other embodiments of the sump system of the present invention, and methods for its installation and use, are envisioned beyond those exemplarily described herein.

As used herein, the term “plurality” refers to two or more items or components. The terms “comprising,” “including,” “carrying,” “having,” “containing,” and “involving,” whether in the written description or the claims and the like, are open-ended terms, i.e., to mean “including but not limited to.” Thus, the use of such terms is meant to encompass the items
5 listed thereafter, and equivalents thereof, as well as additional items. Only the transitional phrases “consisting of” and “consisting essentially of,” are closed or semi-closed transitional phrases, respectively, with respect to the claims.

Use of ordinal terms such as “first,” “second,” “third,” and the like in the claims to modify a claim element does not by itself connote any priority, precedence, or order of one claim
10 element over another or the temporal order in which acts of a method are performed, but are used merely as labels to distinguish one claim element having a certain name from another element having a same name (but for use of the ordinal term) to distinguish the claim elements.

Those skilled in the art should appreciate that the parameters and configurations described herein are exemplary and that actual parameters and/or configurations will depend on
15 the specific application in which the systems and techniques of the invention are used. Those skilled in the art should also recognize, or be able to ascertain, using no more than routine experimentation, equivalents to the specific embodiments of the invention. It is therefore to be understood that the embodiments described herein are presented by way of example only and that, within the scope of the appended claims and equivalents thereto, the invention may be
20 practiced otherwise than as specifically described.

What is claimed is:

CLAIMS

1. A basement sump control system, comprising:

a sump pump; and

a controller in communication with the sump pump, the controller configured to:

5 monitor an operational parameter of the sump pump; and
 override a switch associated with the sump pump to maintain operation of the
 sump pump in response to the monitored operational parameter registering an abnormal
 condition.

10 2. The system of any of the preceding claims, wherein the operational parameter is monitored
periodically.

3. The system of any of the preceding claims, wherein the operational parameter is monitored
continuously.

15 4. The system of any of the preceding claims, wherein the monitored operational parameter
pertains to a sump water level.

20 5. The system of any of the preceding claims, wherein the abnormal condition pertains to a high
sump water level.

6. The system of any of the preceding claims, wherein the monitored operational parameter of
the sump pump pertains to its on/off status, or its transient, surge, or average current draw.

25 7. The system of any of the preceding claims, wherein the monitored operational parameter of
the sump pump pertains to its total hours or total cycles of operation.

8. The system of any of the preceding claims, wherein the controller is further configured to
determine a life expectancy of the sump pump.

30

9. The system of any of the preceding claims, wherein the controller is configured to perform a diagnostic test.

10. The system of any of the preceding claims, wherein the diagnostic test is performed
5 periodically.

11. The system of any of the preceding claims, wherein the diagnostic test is performed weekly.

12. The system of any of the preceding claims, wherein the diagnostic test relates to the
10 controller's functioning and/or communication capability.

13. The system of any of the preceding claims, wherein the diagnostic test involves an exercise of the sump pump.

14. The system of any of the preceding claims, wherein the diagnostic test pertains to power of
15 the controller and/or sump pump.

15. The system of any of the preceding claims, wherein the controller reports results associated
with the diagnostic test.
20

16. The system of any of the preceding claims, wherein the controller is connected to a source of alternating current (AC) power.

17. The system of any of the preceding claims, wherein the sump pump is connected to a source
25 of AC power.

18. The system of any of the preceding claims, wherein the system further comprises a backup battery for the controller.

19. The system of any of the preceding claims, wherein the controller monitors the AC system
30 power.

20. The system of any of the preceding claims, wherein the controller monitors the backup battery.

5 21. The system of any of the preceding claims, wherein the controller provides an indication of battery status and/or battery voltage.

22. The system of any of the preceding claims, wherein the controller is connected to a local area network (LAN).

10

23. The system of any of the preceding claims, wherein the controller operates over a wireless network.

15 24. The system of any of the preceding claims, wherein the controller is further configured to communicate regarding the status of at least one system component or operational parameter.

25. The system of any of the preceding claims, wherein the controller outputs a notification in response to registering an abnormal condition.

20 26. The system of any of the preceding claims, wherein the controller outputs a notification in response to overriding the sump pump switch.

27. The system of any of the preceding claims, wherein the notification is communicated to a smart phone, tablet, or web page interface.

25

28. The system of any of the preceding claims, wherein the notification is directed to a property owner or tenant.

29. The system of any of the preceding claims, wherein the notification is directed to a
30 maintenance technician.

30. The system of any of the preceding claims, wherein the system further comprises an alarm.

31. The system of any of the preceding claims, wherein the controller is configured to generate an alarm signal in response to detecting an abnormal condition.

5

32. The system of any of the preceding claims, wherein the controller is configured to generate an alarm signal in response to detecting a high water level.

10 33. The system of any of the preceding claims, wherein the sump pump is in communication with a first water level sensor.

34. The system of any of the preceding claims, wherein the sump pump is in communication with first and second water level sensors.

15 35. The system of any of the preceding claims, further comprising a second sump pump, wherein the controller is in communication with both sump pumps.

36. The system of any of the preceding claims, wherein the controller includes a reset feature.

20 37. The system of any of the preceding claims, wherein the controller includes a silence feature.

38. The system of any of the preceding claims, further comprising a temperature sensor in communication with the controller.

25 39. The system of any of the preceding claims, wherein the controller is configured to actuate a fan responsive to the temperature sensor.

40. The system of any of the preceding claims, wherein the temperature relates to an inside temperature, an outside temperature, or both.

30

41. The system of any of the preceding claims, further comprising a humidity sensor in communication with the controller.

42. The system of any of the preceding claims, wherein the controller is configured to actuate a
5 vent responsive to the humidity sensor.

43. The system of any of the preceding claims, wherein the humidity level relates to an inside humidity condition, an outside humidity condition, or both.

10 44. The system of any of the preceding claims, wherein the system further comprises a basement fan in communication with the controller.

45. The system of any of the preceding claims, wherein the controller is configured to monitor an operational condition pertaining to the basement fan.

15 46. The system of any of the preceding claims, wherein the operational condition of the basement fan pertains to its total hours or total cycles of operation.

47. The system of any of the preceding claims, wherein the controller is configured to actuate
20 the basement fan to exhaust air periodically if an outside humidity level is about 50% or less.

48. The system of any of the preceding claims, wherein the controller is configured to periodically actuate the basement fan to refresh air regardless of an outside humidity level.

25 49. The system of any of the preceding claims, wherein the system further comprises a dehumidifier.

50. A method of safeguarding a basement environment comprising operating the basement sump control system of any of the preceding claims.

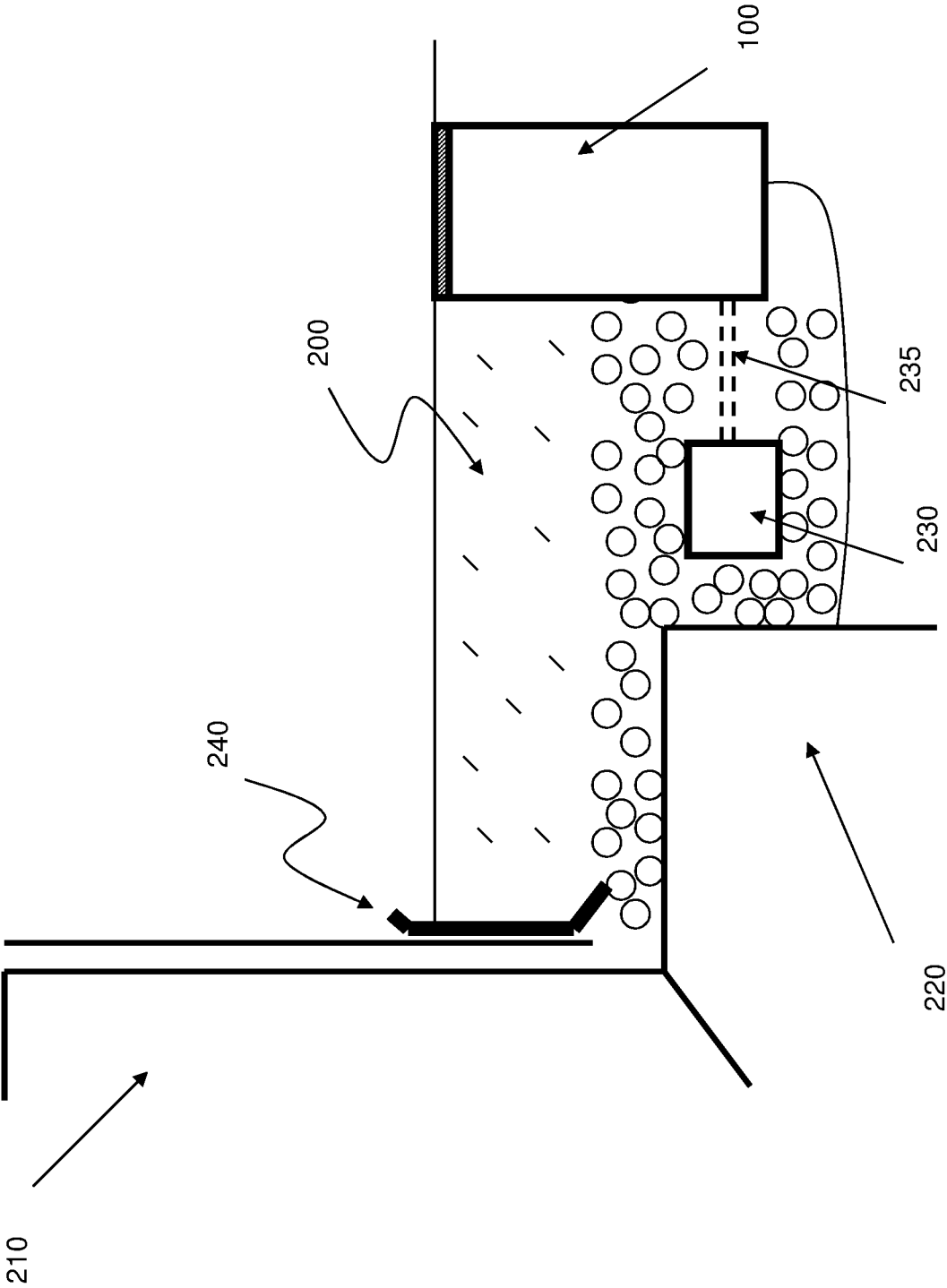


FIG. 1

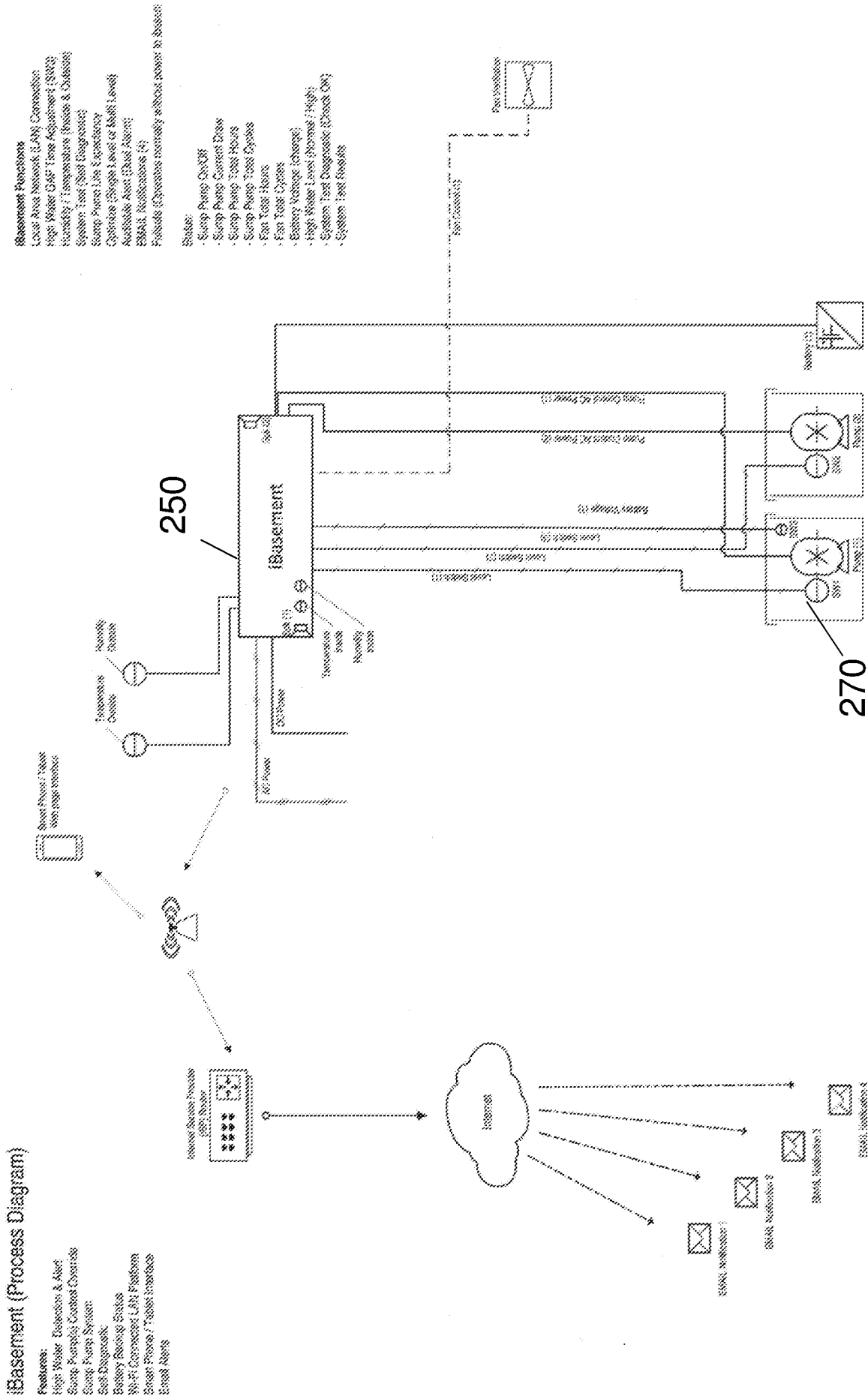


FIG. 2

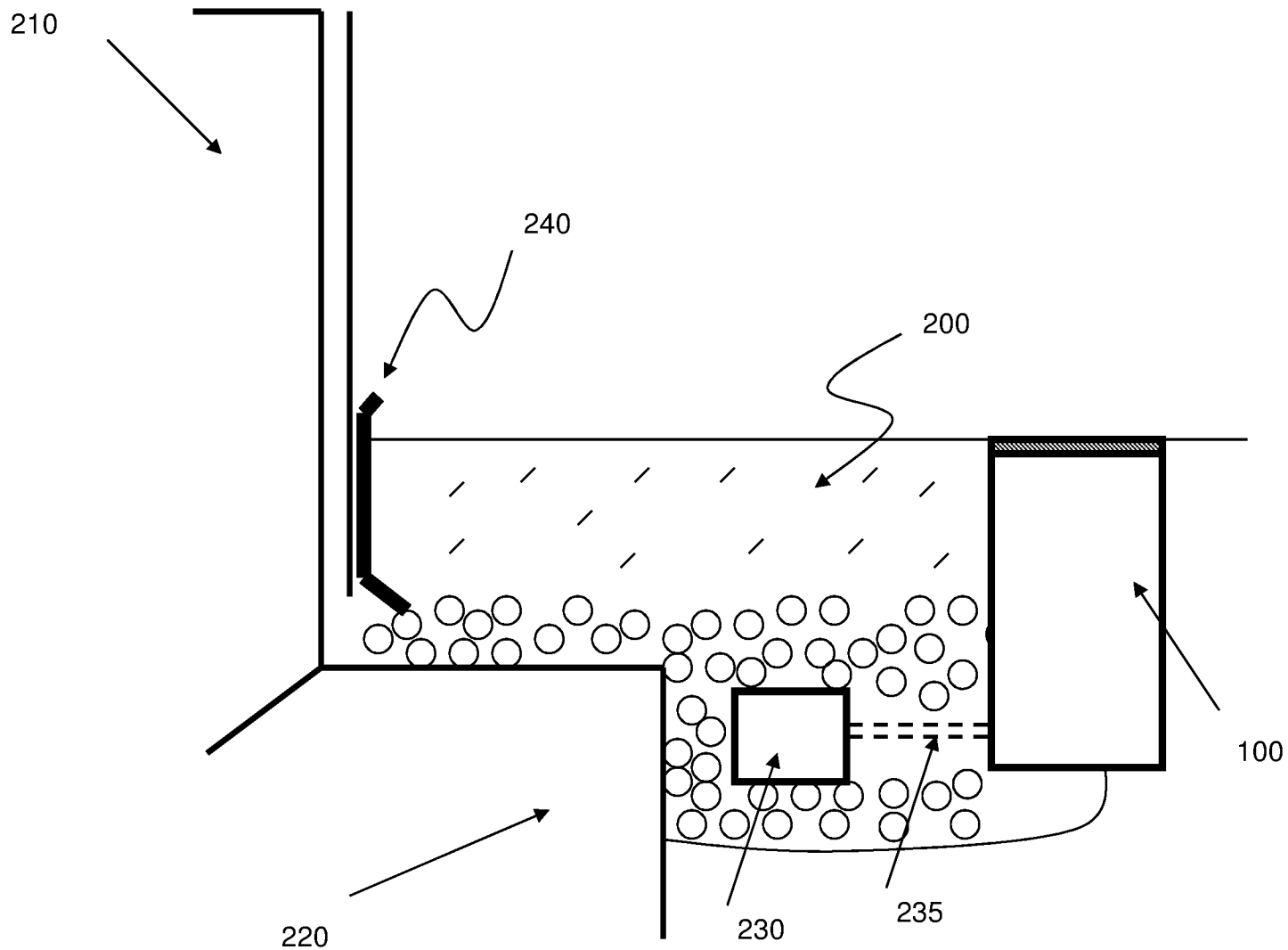


FIG. 1