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(54) **EMERGENCY AUTOMATIC SUMP VALVE**

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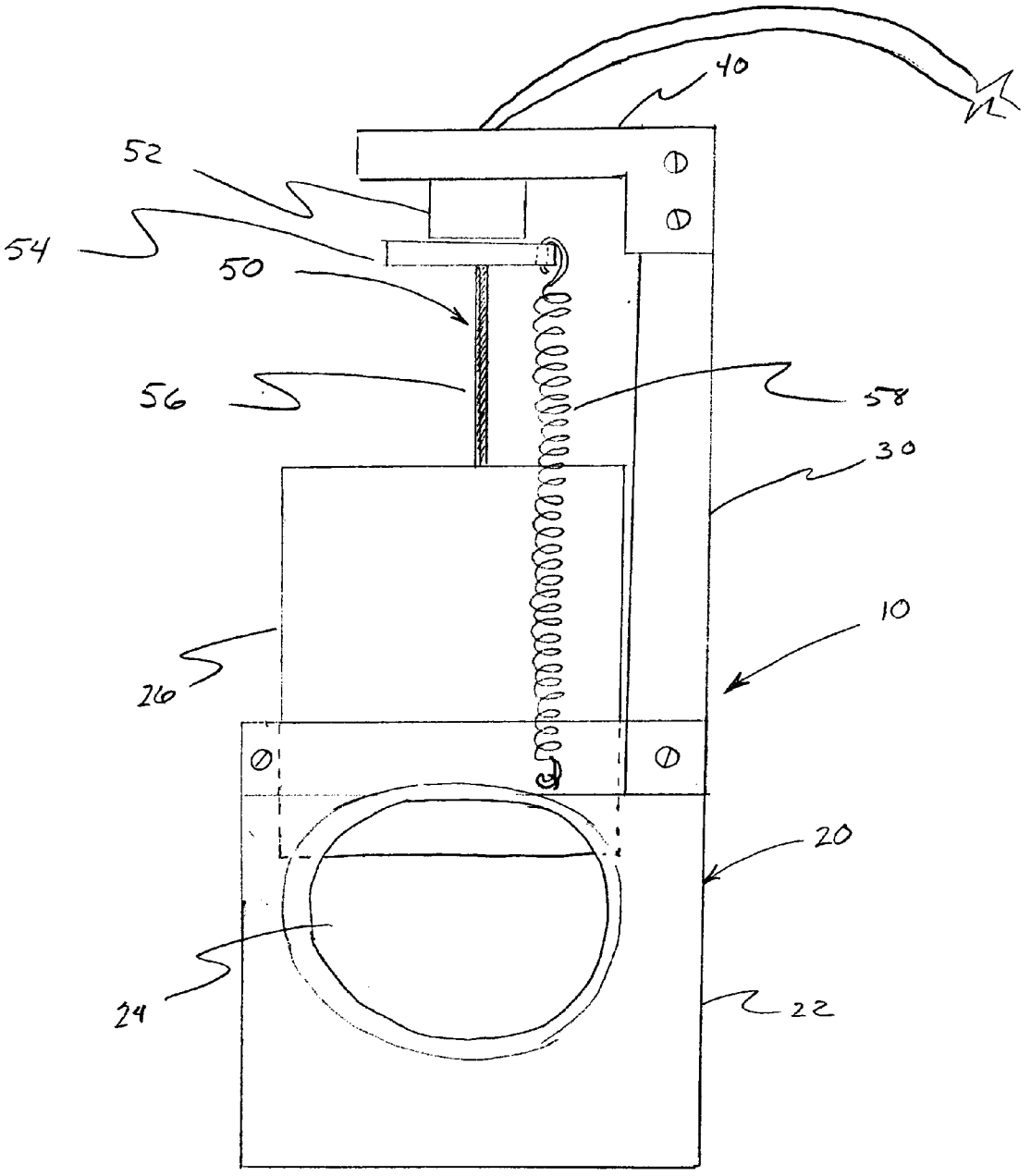
(57) **ABSTRACT**

A system and apparatus for preventing overflow of sump tanks and thereby precluding basement flooding. One embodiment of the apparatus comprises a valve, a flood indicator sensor, an automatic valve actuator connected to the valve, capable of being activated when the flood indicator sensor is triggered.



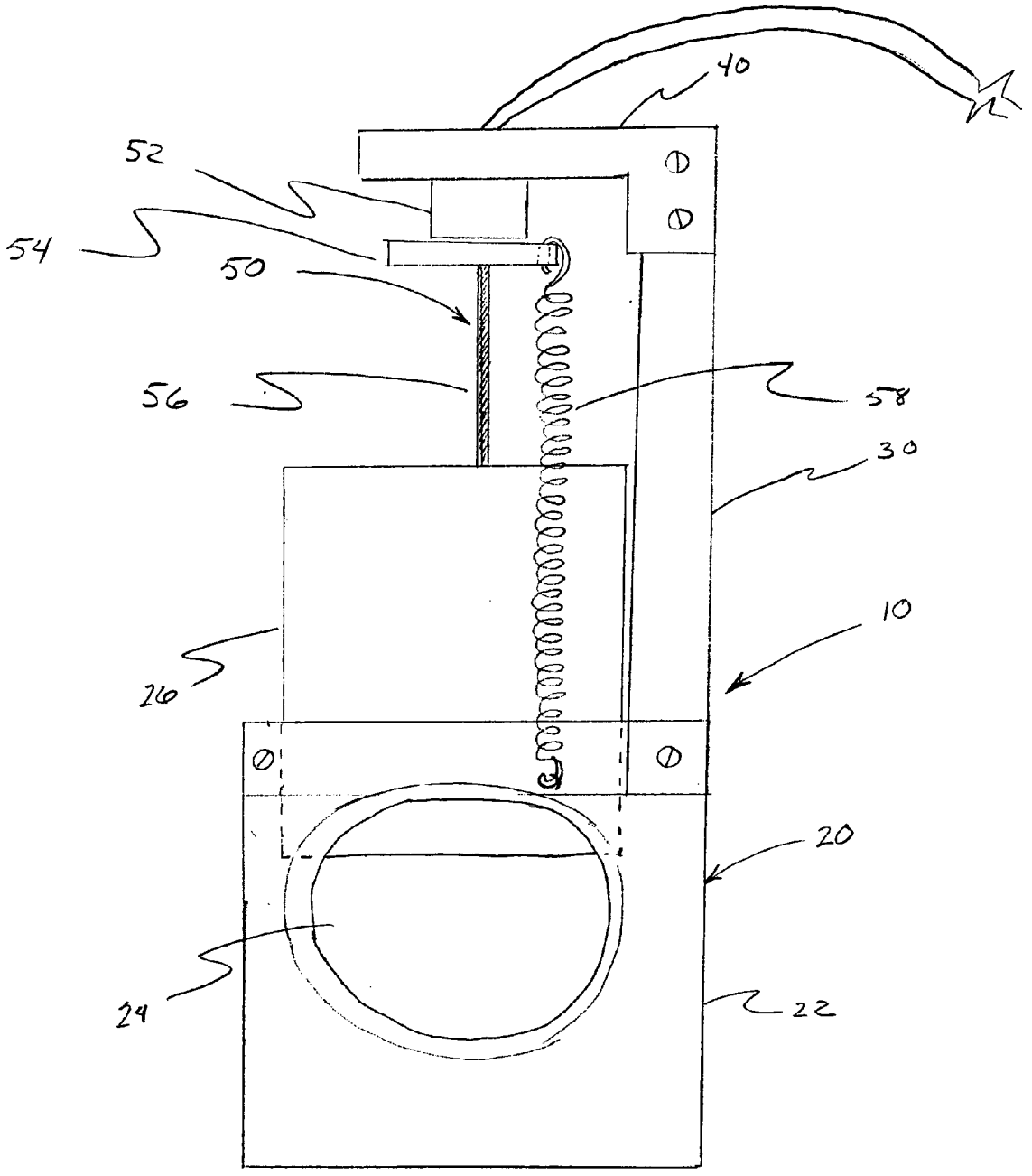


FIG 1

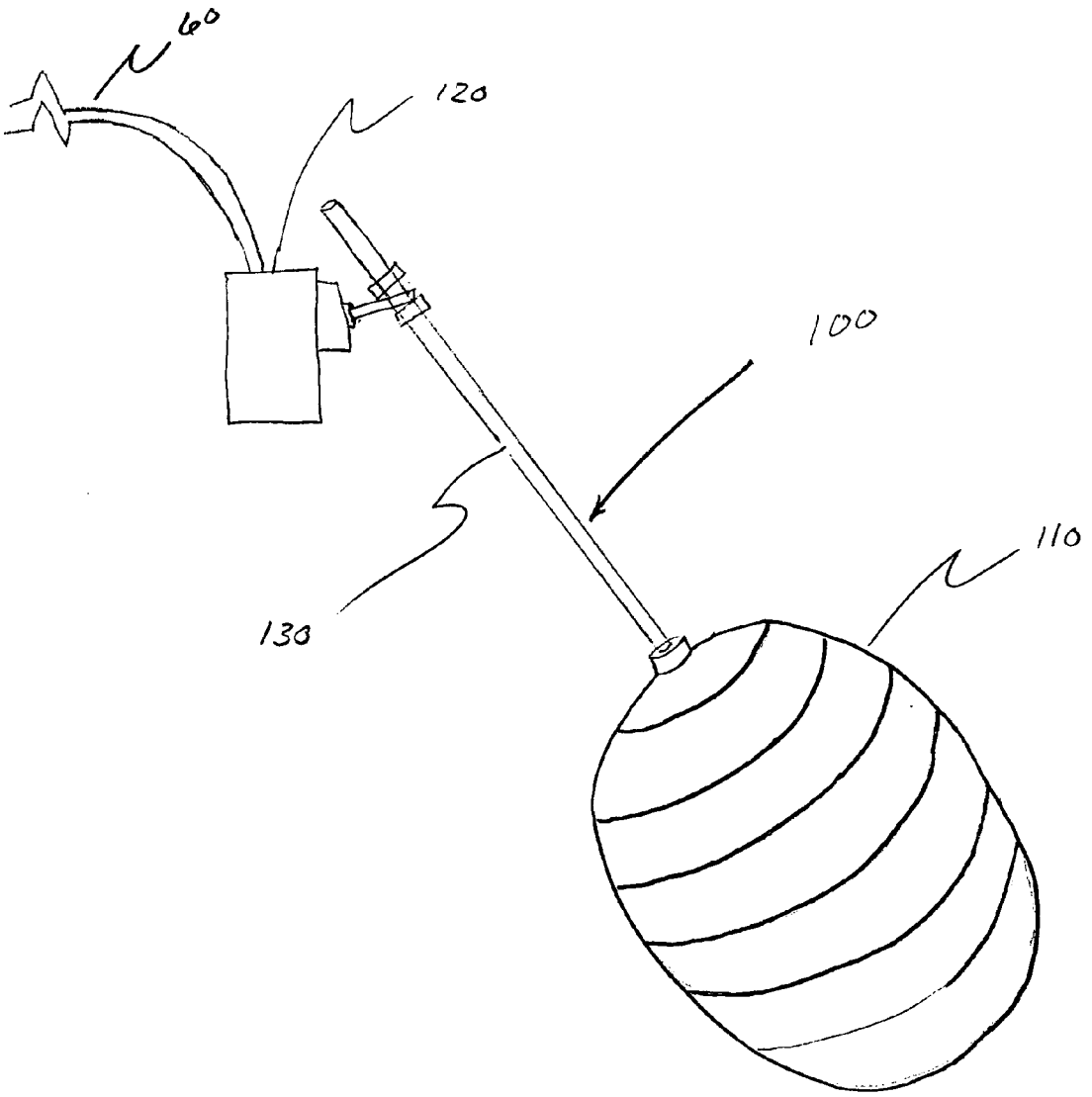


FIG 2

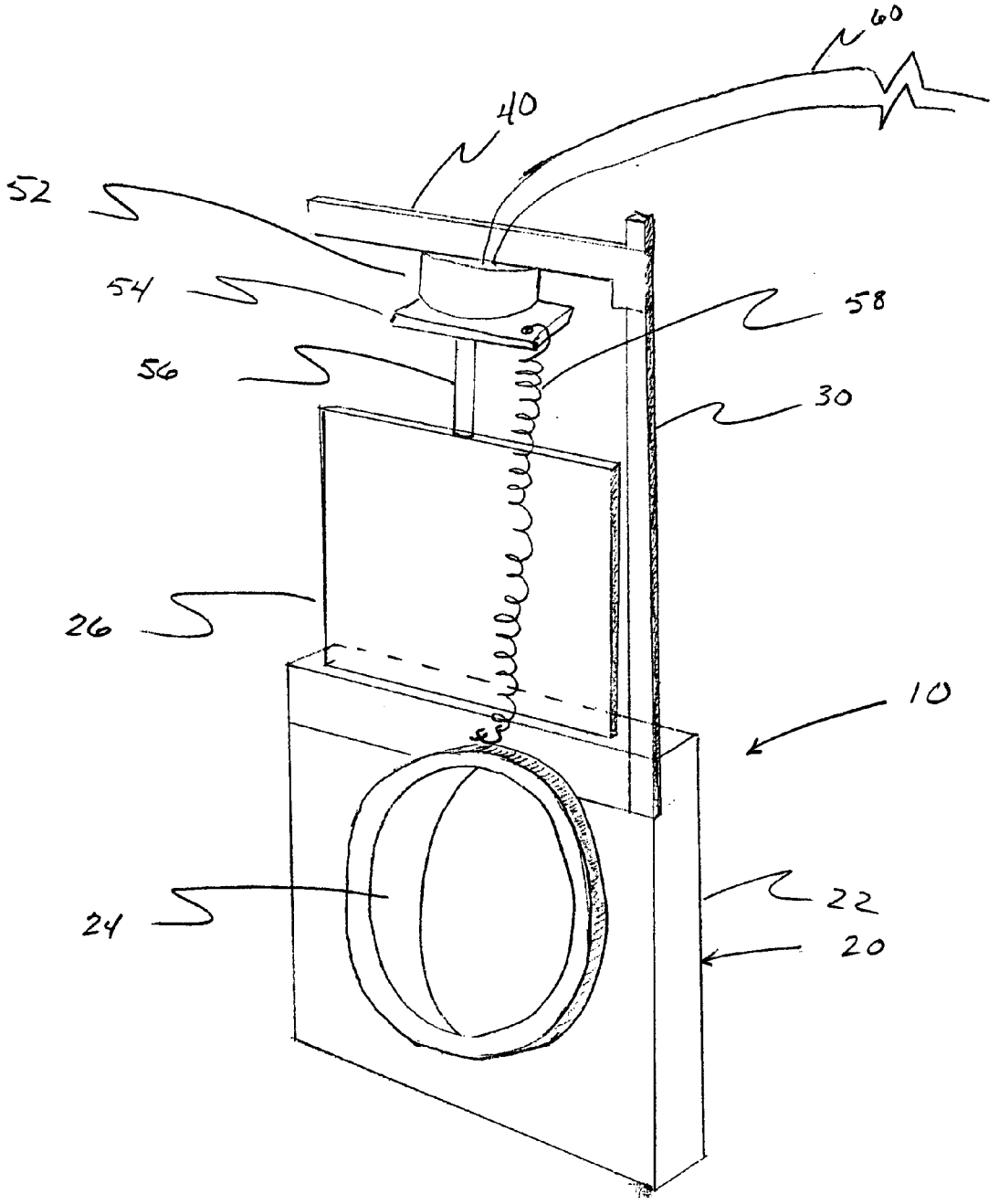


FIG 3

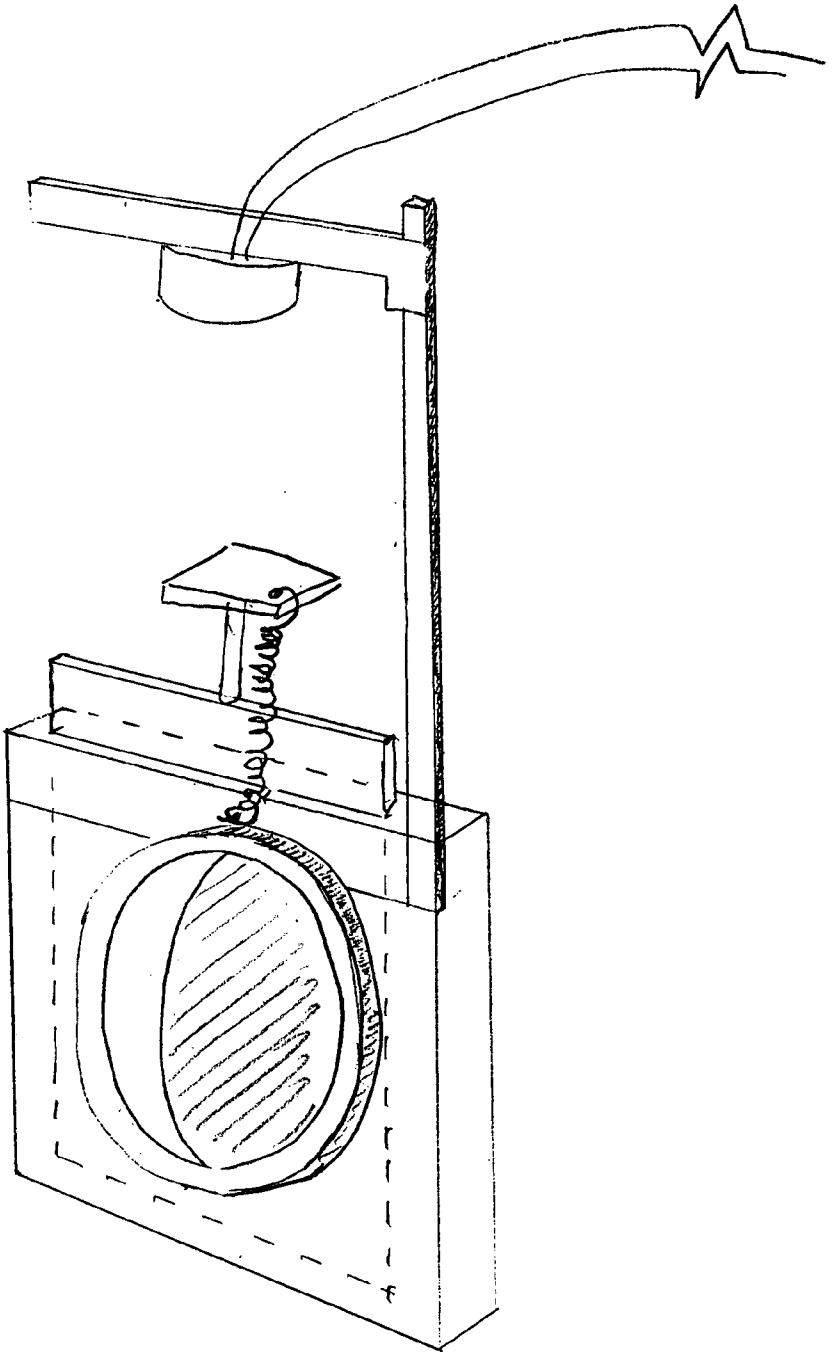


FIG 4

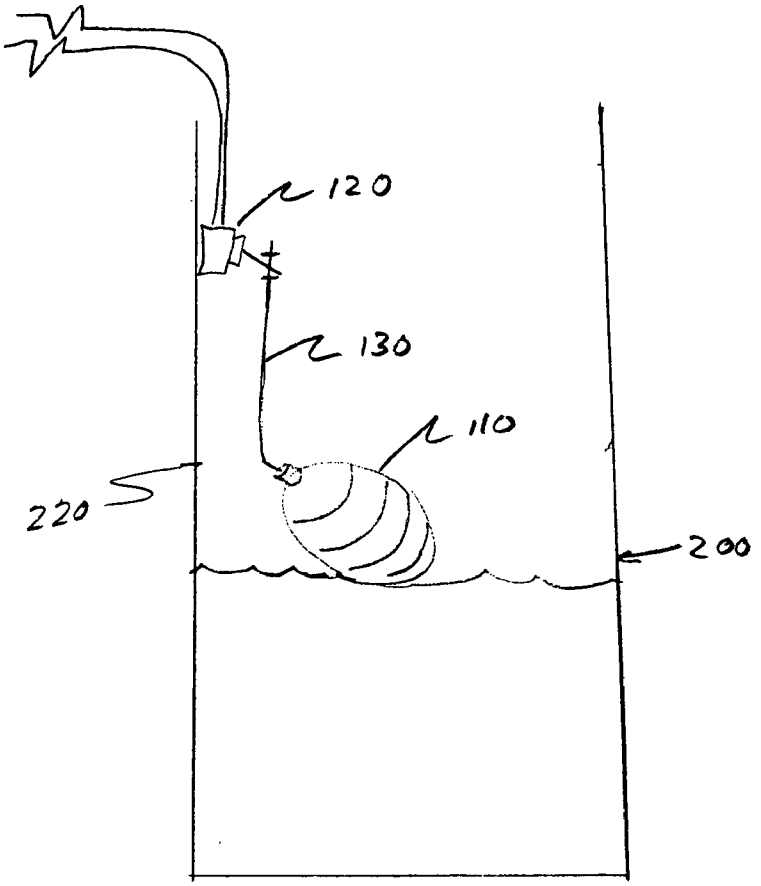


FIG 5A

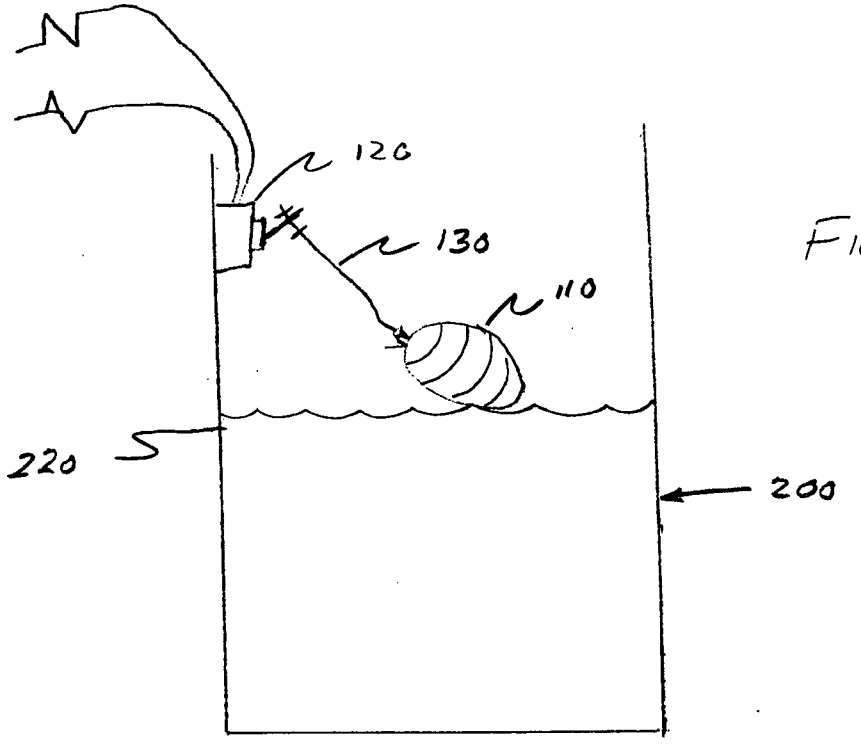


FIG 5B

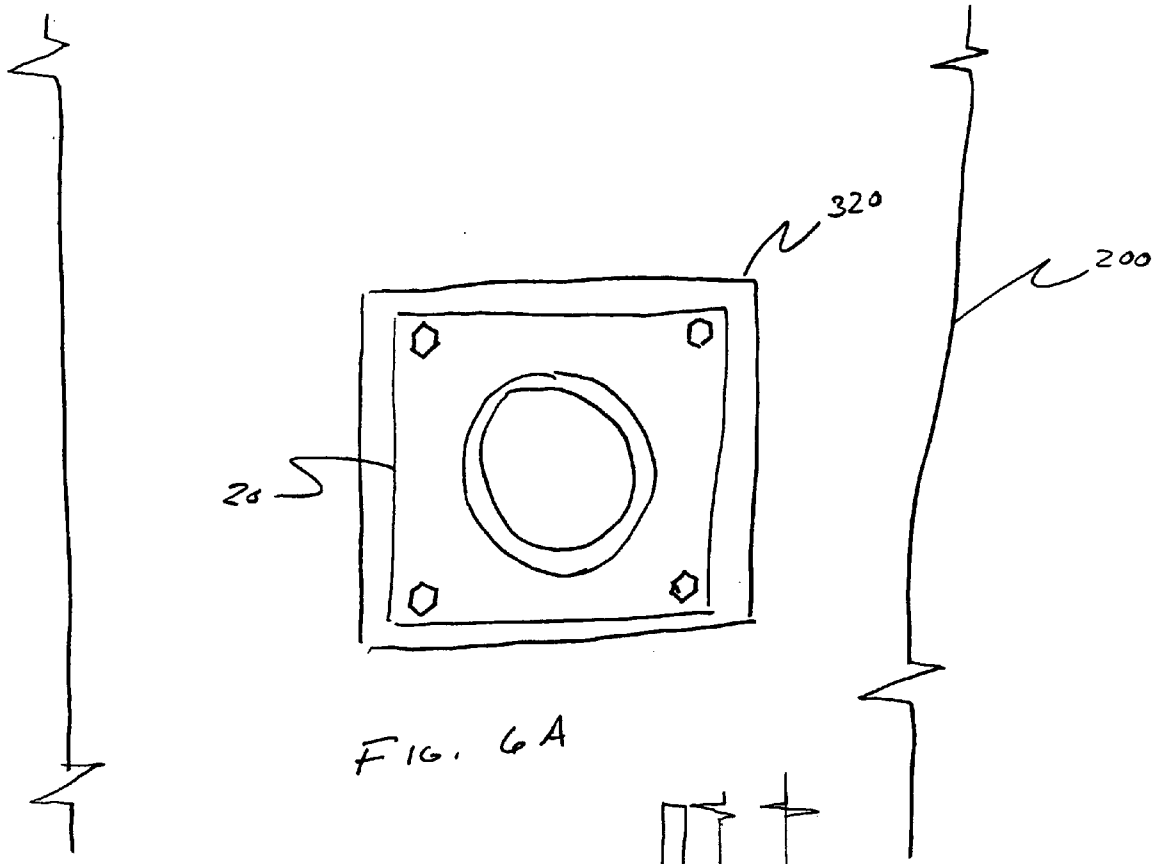


FIG. 6A

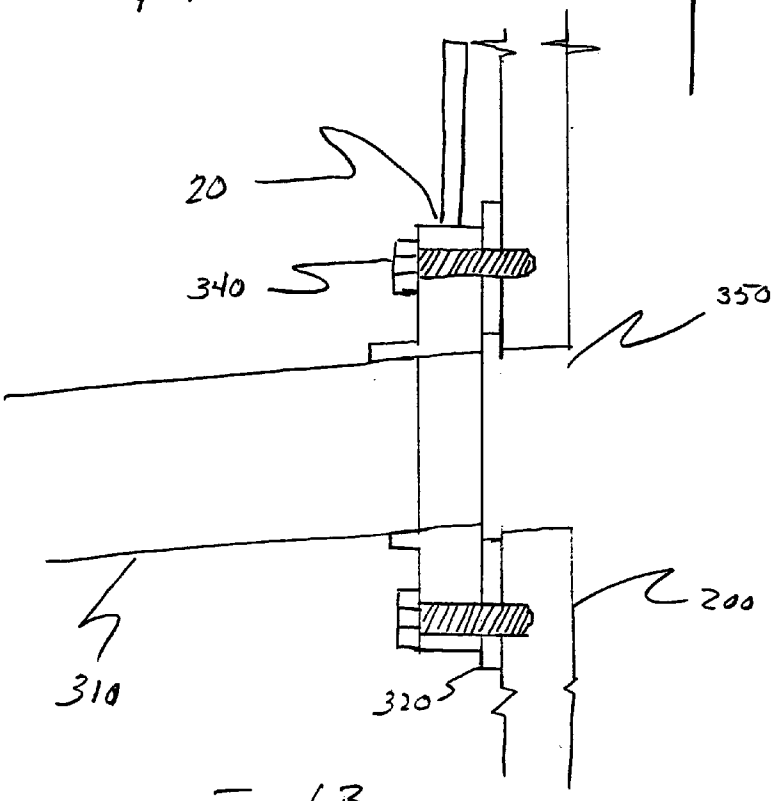


FIG. 6B

EMERGENCY AUTOMATIC SUMP VALVE

BACKGROUND

[0001] Sump pumps are frequently utilized as the first line of defense against water entering a homeowner's basement. A sump pit or tank may be connected to drain tile that drains the footings of the house, under the entire basement, or just the area where the sump tank is located. When water collects in the soil surrounding the tile, gravity causes the water to run down the tiles and into the sump tank via ports in the sides of the sump tank. The sump tank is situated such that water will accumulate in the sump, at a level below the basement or crawl space, to be pumped to a remote location away from the house.

[0002] Water collected in the sump must be removed. If the water is not removed, the sump will overflow as more water drains in, causing flooding to the basement or other areas protected by the drainage system. Typically, water removal is accomplished by utilizing a sump pump. The sump pump functions to pump water out of the sump to a remote location where it will not reinfiltrate the drainage perimeter serviced by the sump. If the water is not removed, or if the water is not removed at a rate faster than it is entering the sump tank, flooding of the basement will ensue as the sump tank overflows. When a basement floods, stored items are lost to water damage, mold and mildew problems are introduced, and the potential of dry rot in any structural wood exposed to the water is introduced. Therefore, a great deal of money is expended in restoring damage from flooding when there is sump pump failure.

[0003] Sump pump failure has a few different sources, but often occurs during times of heavy rainfall or ground saturation. Power outages associated with storms are a common source of pump failure leading to sump flooding. If electrical power is interrupted during a period of intense rain, water can quickly accumulate in the sump and overflow a sump tank, as most sump pumps are electrically powered. When a sump pump fails because of a power outage, there is often additional rainfall that occurs after the outage, causing the water to continue to rise in the sump tank. Backup sump pumps operating on an alternate power source such as a battery are routinely utilized in the industry to reduce the risk of flooding during power outages or until such time that a damaged main pump can be replaced or repaired. However, backup sump pumps typically remove only five to ten gallons per minute, while a sump tank can fill at a rate of forty to seventy gallons per minute during hard rain or heavy ground saturation. Therefore, a backup sump pump is often inadequate to prevent the sump tank from overflowing when the primary sump pump fails. Another common cause of pump failure is pump motor failure due to prolonged use or constant use. Motor failure due to a melted armature or overheating is often associated with extended periods of heavy rain or heavy ground saturation. As such, a means to prevent sump tank overflow during times of intense rain or sump pump failure would be greatly appreciated.

SUMMARY

[0004] One aspect of the present invention, an apparatus for preventing the overflow of a sump, comprises a valve operable to open and close in order to regulate water entry in a sump; an automatic valve actuator connected to the valve; and a sensor operable to detect when a water level exceeds a pre-determined height in a sump and further operable to activate the automatic valve actuator when that occurs. The sensor of the apparatus can comprise a float connected to a toggle switch. Further, the valve of the apparatus can be a gate valve sealably attached to a sump. In the case where the valve is a gate valve, the automatic valve actuator can comprise an electromagnet operable to attract a magnet plate connected to a slidable valve gate of the gate valve when charged, and a spring operable to attract a magnet plate. Because the magnet plate is attached to the slidable valve gate of the gate valve, and the automatic valve actuator further comprises a spring operable to provide tension in a direction opposing an attraction of the magnet plate to the electromagnet, the slidable valve gate is pulled to a closed position when the electromagnet is not charged. Additionally, the valve for the apparatus for preventing the overflow of a sump can be attached to a sump portal.

[0005] Further, the apparatus can additionally comprise a gasket mounted to the valve to provide a water tight seal between the valve and surface to which it is mounted. Optionally, the apparatus can include an automated actuator operable to trigger automatic valve actuator in the event that electrical power is interrupted. Moreover, the apparatus could optionally include an alarm operable to warn a homeowner or third party when the automatic valve actuator has been activated.

[0006] According to another aspect of the present invention, a method of preventing sump overflow comprises the steps of providing a valve operable to close water entry into a sump; providing an automatic valve actuator connected to the valve; providing a sensor operable to detect a water level above a pre-determined height in a sump, and a switch in communication with the sensor, operable to activate the automatic valve actuator. Additionally, the method can comprise the step of activating the automatic valve actuator when the sensor detects the water level above the pre-determined height in the sump. Finally, the method can optionally comprise the further step of providing an alarm operable to alert the homeowner or a third party when the automatic valve actuator is activated.

[0007] Further, according to another aspect of the present invention, an apparatus for preventing the overflow of a basement sump having at least one water intake portal comprises a valve having a slide body member with an opening through it, a gate adapted to slide within the slide body member to open and close the opening in the slide body member, with the slide body member mounted to a wall of the sump over the at least one water intake portal so that the opening aligns with the intake portal; a magnetic plate attached to the gate; a structure urging the gate toward a closed position; an electromagnet operable to attract an hold the magnetic plate when electrical power is applied to the electromagnet to retain the gate in an open position; a switch operably connected between said electromagnet and a source of electrical power so that electrical power is applied to the electromagnet when the switch is closed and electrical power to the electromagnet is terminated when the switch is opened; and a water level sensor located in the sump operably connected to the switch so that the switch closes when the water level in the sump is below a predetermined level and opens when the water level in the sump

exceeds a predetermined level and opens when the water level in the sump exceeds a predetermined level to interrupt power to the electromagnet so that the gate closes the opening to close the valve and prevent further intake of water through the intake portal. Further, the structure urging the gate toward a closed position can comprise a spring. Additionally, the water level sensor in the apparatus can comprise a float. Finally, the apparatus can further comprise a seal positioned around the opening between the slide body member and the wall of the sump to which the valve is attached to prevent water from leaking around the slide body member.

[0008] The above brief description sets forth rather broadly the more important features of the present invention with the intention that the following detailed description may be better understood, and the present contributions to the art may be better appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will be for the subject matter of the claims appended hereto.

[0009] Those skilled in the art will appreciate that the conception, upon which the disclosure is based, may be readily utilized as a basis for designing other structures, methods, and systems for carrying out the several purposes of the present invention. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] **FIG. 1** is a front plan view of an automatic valve assembly according to one aspect of the present invention.

[0011] **FIG. 2** is a left plan view of a float switch according to one aspect of the present invention.

[0012] **FIG. 3** is a right front perspective view of an automatic valve assembly in its open position according to one aspect of the present invention.

[0013] **FIG. 4** is a right front perspective view of an automatic valve assembly in its closed position according to one aspect of the present invention.

[0014] **FIG. 5A** is a plan view of a float switch within a sump wherein the water level has not reached a critical level.

[0015] **FIG. 5B** is a plan view of a float switch within a sump wherein the water level has reached a critical level.

[0016] **FIG. 6A** is a front plan of an automatic sump valve attached to a sump tank.

[0017] **FIG. 6B** is a cross-section view of an automatic sump valve attached to a sump tank.

DESCRIPTION

[0018] The subject invention is a method and apparatus for preventing the overflow of a sump in the event that the sump pump fails, electricity fails, or the rate of water incoming exceeds the pump rate of water expulsion. Preventing overflow of the sump tank greatly reduces the risk of basement flooding, as the sump tank is usually lower than the basement floor. In application, the subject invention prevents the sump tank from overflowing by closing the valve passage(s) where a drainage tile enters the sump should primary pump failure occur.

[0019] According to **FIG. 1**, a side view of one embodiment of the present invention, an emergency automatic sump valve **10** is comprised of a gate valve **20** having a rectangular valve body **22** having an opening **24** there through and a slidable valve gate **26** adapted to slide within valve body **22** to close opening **24**. Gate valve **20** also includes a vertical support **30**, a horizontal support **40**, and magnetic plate **54** and push rod **56** attached to slidable valve gate **26**. In this embodiment, valve **20** comprises a gate valve such as a 3" Bladex™ waste valve typically used in the recreation vehicle industry manufactured by Valterra Products, Inc. of 15230 San Fernando Mission Blvd., Suite #107, Mission Hills, Calif. 91345. However several different valve styles could be used, as long as the valve can be positioned to control the flow of water into the sump and can be controlled by an automatic switch **50**. Therefore, ball valves, butterfly valves, or other suitable valve types could be used in place of a gate valve as shown.

[0020] However, in the present embodiment, gate valve **20** comprises valve body **22** having a valve opening **24** wherein liquid may flow through. Further, valve body comprises a slot (not shown) wherein a slidable valve gate **26** may slidably move into an open and closed position to allow or block the flow of liquids through valve opening **24** when the slidable valve gate is in its respective positions. When slidable valve gate is held up so as not to cover the valve opening **24**, the gate valve **20** is said to be in an open position; when the slidable valve gate **26** is down such that valve opening **24** is blocked, the valve is said to be closed.

[0021] Further, this embodiment of the present invention includes an automatic valve actuator **50** comprising electromagnet **52**, magnet plate **54**, pushrod **56**, and tension apparatus **58**. In application, electromagnet **52** (such as model E-09-150-30 produced by Magnetic Sensor Systems of Van Nuys, Calif.) uses magnetic force to attract magnetic plate **54**, exerting an upward force on magnet plate **54** when charged. Magnet plate **54** can be manufactured from any material capable of being magnetically attracted to electromagnet **52** when charged, but is manufactured of steel in the present embodiment. Further, an opposite downward force is applied to magnet plate **54** by tension apparatus **58** such that the upward force applied to magnet plate **54** by electromagnet **52** when charged exceeds the downward force applied to magnet plate **54** by tension apparatus **58**, keeping magnet plate held against electromagnet **52**. However, when electromagnet **52** is not charged, the downward force of tension apparatus **58** exceeds any residual upward magnetic force, causing magnet plate **54** to move downward toward valve body **22**. It should be noted that charge to electromagnet **52** is provided by current through electrical wires **60**, and can be accomplished through several voltage and current settings. However, in this embodiment, the electric current causing magnetic charge of electromagnet **52** is a twelve volt DC current accomplished by a step-down transformer (not shown) to prevent severe shock hazard if the components were to come in contact with water.

[0022] Because magnet plate **54** is connected to slidable valve gate **26** via pushrod **56**, slidable valve gate **26** slides into its open or closed position when magnet plate **54** is in

its upward or downward position, respectively. Therefore, when electromagnet **52** is charged, valve gate is in its open position, as shown in **FIGS. 1 and 3**, and water may freely pass through valve opening **24**. When electromagnet **52** is not charged, slidable valve gate **26** is snapped into its closed position by tension from tension apparatus **58**, as shown in **FIG. 4**, and water does not pass through valve opening **24**. Tension apparatus **58**, as shown, is a coil spring in this embodiment, but could comprise an elastic band, rubber band, conventional magnet of a lesser force than the charged force of electromagnet **52**, or any other device capable of producing a constant downward force.

[**0023**] **FIG. 2** details the assembly of one embodiment of a sensor **100** for detecting water height above a critical level in a sump tank. In application, sensor **100** operates to deploy automatic valve actuator **50** to place valve **20** in a closed position. In this embodiment, sensor **100** comprises a float **110** connected to a toggle switch **120** via a threaded rod **130**. Float **110** can be adjusted on threaded rod **130** so that switch **120** is deployed when float **110** reaches different heights. However, sensor **100**, once calibrated for float **110** to flip toggle switch **120** off when float reaches a given height (hereinafter the "critical level **220**") will operate to switch off the electrical current flowing to electromagnet **52** of automatic valve actuator **50** via electrical wires **60**. Thus, as show in **FIG. 5A**, when water in sump **200** is below critical level **220**, sensor **100** is not activated, and toggle switch **120** remains in the "on" position, allowing current to pass to electromagnet **52**, keeping valve **20** in the open position as shown in **FIGS. 1 and 3**. However, once water in sump **200** exceeds the critical level **220**, float **110** causes toggle switch to be placed in the "off" position, thereby eliminating current to electrical lines **60**, and stopping charge to electromagnet **52**. Therefore, when water is above the critical level **220**, automatic valve actuator **50** is deployed to snap valve into closed position as shown in **FIG. 4**, preventing further water from entering sump **200**.

[**0024**] Once the automatic valve actuator is activated, water can no longer enter sump **200** once valve is snapped into the closed position, sump does not overflow and cause basement flooding. This gives the homeowner some time to determine the cause of the sump pump failure and remedy the problem before re-opening valve **20** to allow any accumulated water in the tiles to empty into the sump **200**. In the present embodiment, once the water returns below critical level **220** by remedying the cause for pump failure, homeowner or technician can re-open valve **20** by pulling up on slidable valve gate **26** until magnet plate **54** once again comes in contact with electromagnet **54**, causing the valve to remain in the open position.

[**0025**] Further, it should be noted that in the present embodiment, in which electromagnet **52** is contemplated to be charged by electrical current originating from a household power source, automatic valve actuator will be deployed to snap valve into the closed position whenever electrical power to the household is interrupted. Therefore, valve **20** will have to be re-opened when electrical power is returned, according to the present embodiment. However, automatic actuator during times of electrical power interruption is designed to prevent overflow of the sump **200** during a time when the sump pump is not powered.

[**0026**] In addition to the structures shown, automatic actuator **50** or sensor **100** can be associated with an alarm (not shown) to alert the homeowner or a security firm hired by the homeowner. The alarm can be configured to notify the homeowner that the sump has reached critical level **220** allowing the homeowner to determine whether a the sump pump should be checked or replaced. The alarm, when activated, could activate a light emitting diode (LED) on a display panel or could activate a siren or bell. In one embodiment of the present invention, the alarm could be a high intensity buzzer like those offered by Radio Shack, operating on a 9-16 volt circuit and powered by a simple 9 volt battery and operable to be activated by a simple pressure switch that is triggered by magnet plate **54** moving away from electromagnet **52**. Additionally, the alarm could be further be configured to be integrated into a home alarm system, thereby allowing a hired third party to be notified when the automatic valve actuator is activated in the event that the homeowner is not at home at the time of pump failure. If the valve was closed due to power outage, the homeowner can simply pull the valve back open by lifting slidable valve gate **26** to place magnet plate **54** back into contact with electromagnet **52** once electrical power is restored.

[**0027**] Finally, **FIG. 6A** shows a plan view and **FIG. 6B** shows a cross section view of valve **20** mounted to the wall of sump **200**. Valve body can be mounted on the interior or exterior of the sump tank **200** at a portal **350** where a tile **310** empties into sump **200**. Valve **20** is attached to the wall of sump **200** by means of bolts **340**, screws, other fasteners, or adhesive. Further, valve **20** is sealably engaged with the wall of sump **200** by way of a water-tight gasket **320**. Typically, gasket **320** is made of flexible, water-resistant material such as rubber, neoprene, plastic, plumber's putty, or other suitable material. Further, the need for gasket **320** can be eliminated through the use of waterproof adhesives in place of or in addition to any fasteners used to connect valve **20** to the wall of sump **200**. Further, if valve **20** is located on the exterior of sump **200** as shown, tile **310** is connected to valve **20**. The connection between valve **20** and tile **310** can be made watertight through the use of gaskets, o-rings, rubber pipe connectors, or other plumbing connections.

[**0028**] While great detail has been given to this embodiment, the present invention can take many forms, and other embodiments of the present invention are envisioned. For example, sensor **100** could comprise one of several commercially available moisture sensors such as those manufactured by Honeywell to activate the automatic valve actuator when water reaches the critical level. Further, several configurations of float switches exist in the art today, many of which would be used to activate the automatic valve actuator. Additionally, the automatic valve actuator could comprise many embodiments, all having the functionality of shutting off the flow of water through the valve when activated. Additionally, those in the art will appreciate several obvious variations of each component.

What is claimed is:

1. An apparatus for preventing the overflow of a sump, the apparatus comprising:

a. a valve operable to open and close to regulate water entry into the sump;

b. an automatic valve actuator connected to the valve; and

c. a sensor operable to detect a water level above a pre-determined height in a sump;

and further operable to activate the automatic valve actuator to close the valve when the water level exceeds the pre-determined height.

2. The apparatus of claim 1, wherein the valve is attached to a sump portal.

3. The apparatus of claim 1, further comprising a gasket mounted to the valve to provide a water tight seal between the valve and a surface of the sump to which it is mounted.

4. The apparatus of claim 1, further comprising structure operable to trigger automatic valve actuator in the event that electrical power is interrupted.

5. The apparatus of claim 1, further comprising an alarm operable to warn a homeowner or third party when the automatic actuator has been activated.

6. The apparatus of claim 1, wherein the sensor comprises a float connected to a toggle switch.

7. The apparatus of claim 1, wherein the valve is a gate valve sealably attached to a water entry of a sump.

8. The apparatus of claim 7, wherein the automatic valve actuator comprises a magnet plate connected to a slidable valve gate of the gate valve and capable of being attracted to the electromagnet when the electromagnetic is electrically charged, and an electromagnet spring operable to provide tension in a direction opposing an attraction of the magnet plate to the electromagnet so that the slidable valve gate can be pulled to a closed position when the electromagnet is not electrically charged.

9. A method of preventing sump overflow, the method comprising the steps of:

a. providing a valve operable to close water entry into a sump;

b. providing an automatic valve actuator connected to the valve;

c. providing a sensor operable to detect a water level above a pre-determined height in a sump; and

d. providing a switch in communication with the sensor, operable to activate the automatic valve actuator to close the valve when the water level is above the predetermined height.

10. The method of claim 9, further comprising the step of automatically activating the valve when electrical power is interrupted.

11. The method of claim 9, further comprising the step of providing an alarm operable to alert the homeowner or a third party when the automatic valve actuator is activated.

12. An apparatus for preventing the overflow of a basement sump having at least one water intake portal, the apparatus comprising:

a valve comprising a slide body member having an opening there through, a gate adapted to slide within the slide body member to open and close the opening in the slide body member, the slide body member mounted to a wall of the sump over the at least one water intake portal so that the opening aligns with the intake portal;

a magnetic plate attached to the gate;

structure urging the gate toward a closed position;

an electromagnet operable to attract and hold the magnetic plate when electrical power is applied to said electromagnet to retain the gate in an open position;

a switch operably connected between said electromagnet and a source of electrical power so that electrical power is applied to the electromagnet when the switch is closed and electrical power to the electromagnet is terminated when the switch is opened; and

a water level sensor located in the sump, the water level sensor operably connected to the switch so that the switch closes when the water level in the sump is below a predetermined level and opens when the water level in the sump exceeds a predetermined level to interrupt power to the electromagnet so that the gate closes the opening to close the valve and prevent further intake of water through the intake portal.

13. An apparatus as claimed in claim 12, wherein the structure urging the gate toward a closed position comprises a spring.

14. An apparatus as claimed in claim 12, where in the water level sensor comprises a float.

15. An apparatus as claimed in claim 12, further comprising a seal positioned around the opening between the slide body member and the wall of the sump to which the valve is attached to prevent water from leaking around the slide body member.

* * * * *