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(54) **FLOW CONTROLLER FOR LIQUIDS, HAVING AN ENERGY SUPPLY BY MEANS OF THE FLOW**

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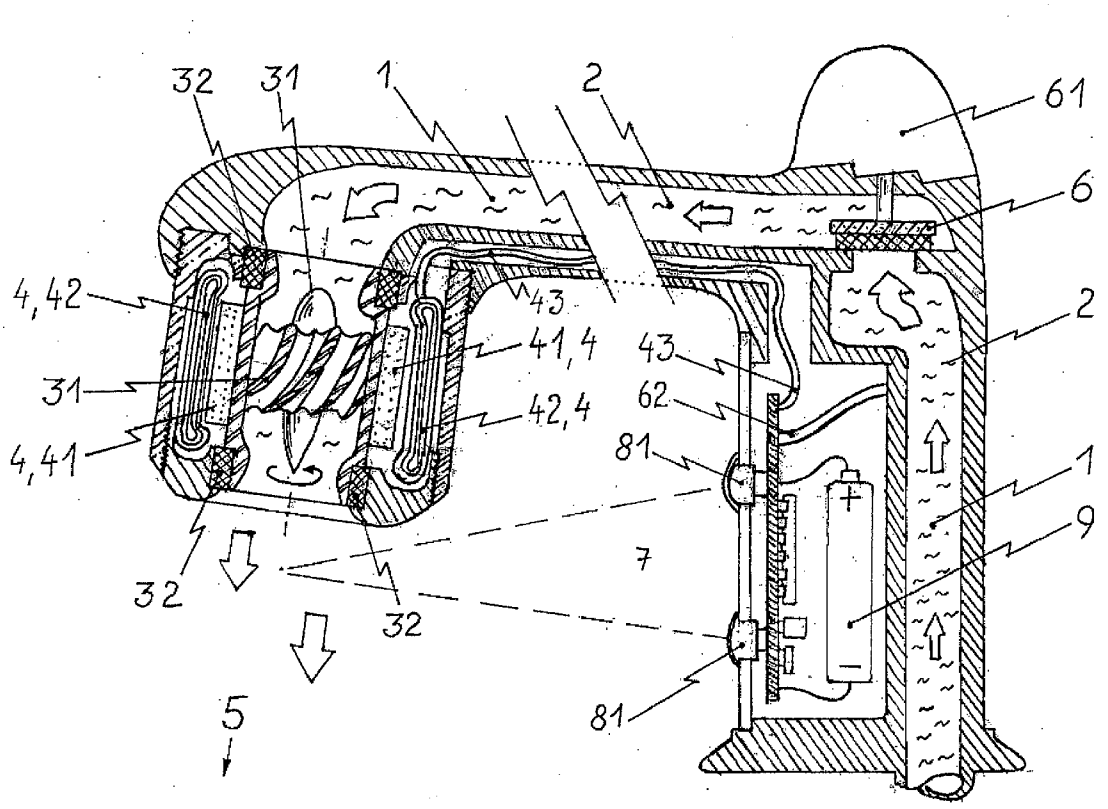
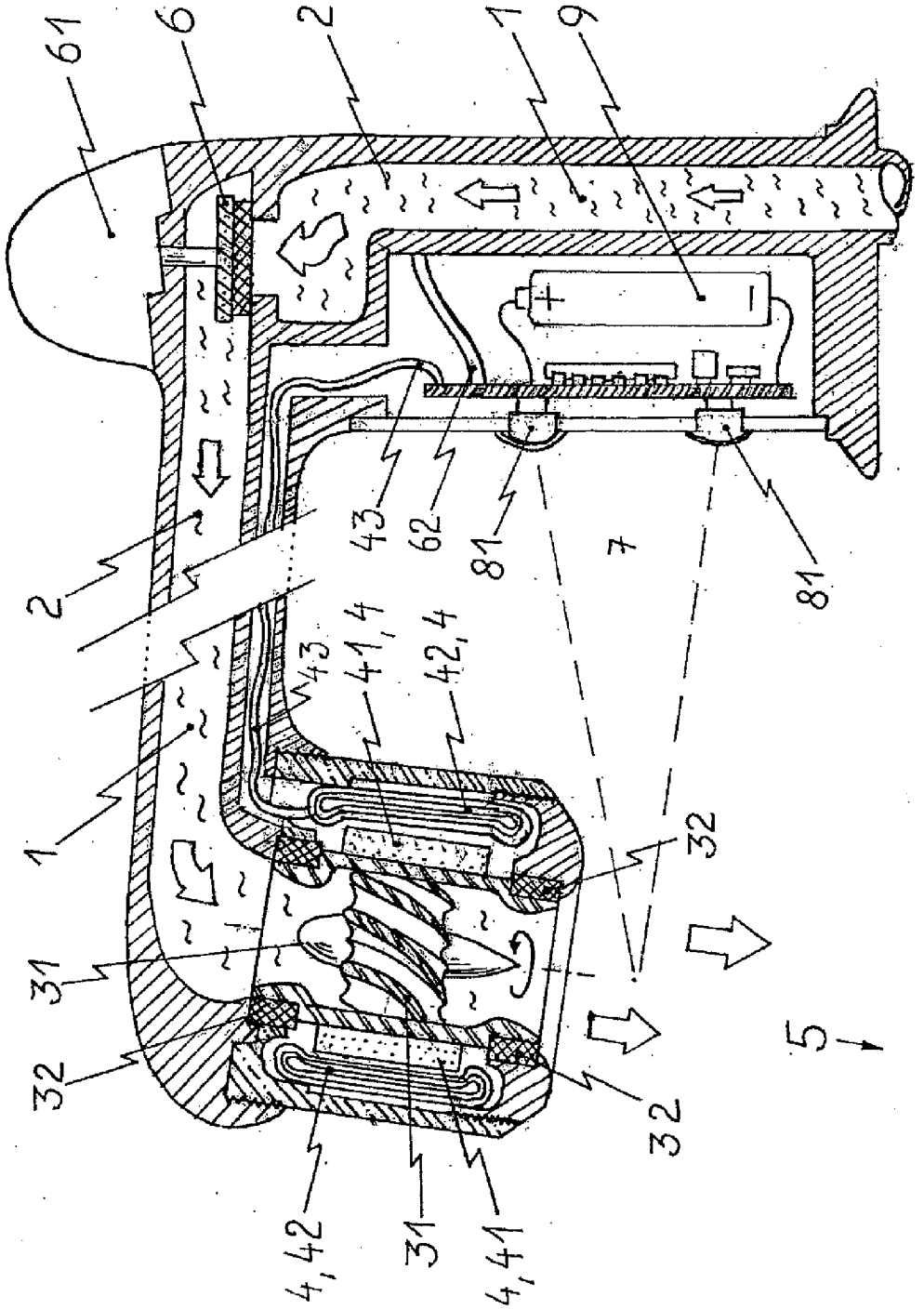
(57) **ABSTRACT**

The invention relates to a flow controller for fluids, having an energy supply by means of the flow of said fluid. Said flow controller consists of a supply line for the fluid and a turbine wheel which is rotationally mounted and through which the fluid flows and which drives an electric generator which charges the energy accumulator and a consumption point for the fluid. The forwarding of the liquid can be blocked by a shut-off valve which can be electrically controlled by control electronics which use at least one sensor and which can be adapted to various types of sensors and to the characteristics of the various types of consumption points and the shut-off valve, the control electronics and the sensor can be supplied with electric energy by the energy accumulator.

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FLOW CONTROLLER FOR LIQUIDS, HAVING AN ENERGY SUPPLY BY MEANS OF THE FLOW

[0001] The invention relates to a flow controller for liquids, having an energy supply by means of the flow of said liquid, said flow controller consisting of a supply line for the liquid and a turbine wheel, which is rotationally mounted and through which the liquid can flow and which drives an electrical generator which charges an energy accumulator and a consumption point for the liquid.

[0002] In the prior art, the consumption of liquids has become an everyday activity for everyone. Probably the most frequent application example is the supply of water to washbasins, toilets, showers, bathtubs, bidets and other elements in the sanitary area.

[0003] Another form of consumption of liquid is a radiator. Here, liquid is supplied, of which only the heat contained therein is "consumed."The liquid itself is, after cooling, returned for heating. In everyday language, it is also termed "consumption" If beverage liquids are drawn from a dispenser and drunk.

[0004] Consumption of water also includes watering plants.

[0005] All these application cases have one thing in common, namely that the supply of the liquid to the consumption point must be controlled. In the simplest case it only needs to be switched off and on.

[0006] In the prior art, numerous variants of mechanical valves are known, which are manually operated by means of a hand wheel or by means of a lever. Also known are electrically switchable valves, which are not only used in large systems but, e.g., also in public toilets for opening and closing the water supply line for hand washbasins and urinals.

[0007] In particular from these application cases, it is known that mechanical shut-off valves can be contaminated so that the user is very reluctant to touch them. The use can avoid this contact if a sensor registers, for example, the hands below the water faucet of a hand washbasin or a different sensor registers that a person approaches a urinal and than moves away from it again.

[0008] These electrical circuits have the disadvantage that not only a water line, but also an electrical line, must be laid to the tap point. Since the electrical line can come into contact with liquid, it must be executed with elevated moisture resistance. One effort is also the laying and connecting of the electrical line.

[0009] This effort is still within reasonable limits in the case of a new building. However, in the case of retrofitting a tap point with an electrically operated shut-off valve, a considerable engineering effort is necessary.

[0010] In the prior at, German Offenlegungsschift DE 101 44 602, Lorenz, describes a water wheel against which the liquid at the tap point flows. On the shaft of this water wheel, an electrical generator is disposed, which, as the water wheel rotates, generates electrical energy, which is used for illuminating the water jet.

[0011] This Offenlegungsschrift, however, does not provide indication of how the liquid stream itself can be controlled.

[0012] Against this background, it is the object of the invention to develop a device for drawing of liquids comprising a generator in the liquid stream, with which the energy generated from the electrical generator can be used to actuate the liquid streams appropriate to the respective application. In particular, a central functional unit is to be created, which is universally applicable and adaptable for applications of a wide variety of kinds and of a wide variety of sizes.

[0013] As a solution, the invention teaches that the transmission of liquid can be blocked by a shut-off valve, which can be electrically actuated by control electronics, which evaluates at least one sensor and which can be adapted to various types of sensors and to the characteristics of various types of consumption points, and the shut-off valve, the control electronics and the sensor can be supplied with electrical energy from the energy accumulator.

[0014] The decisive feature of the invention is thus the connection of an electrically actuatable shut-off valve with control electronics adapted thereto, which comprises variability for the connection of various types of sensors. The control electronics monitors the energy supply for at least one sensor.

[0015] In addition, the connections for these sensors are present in the hardware and additionally a preprogrammed selection of algorithms, of which one serves for adaptation to the operating characteristic of the sensors that are used in each case.

[0016] The control electronics are additionally equipped with various software blocks for the evaluations of the sensors in adaptation to the respective application case.

[0017] For a mechanical switch, it is appropriate that it is "debounced" in the control electronics. In the case of a change of the switch position, that contact of a mechanical switch jumps back somewhat after the first encounter with its contact surface, and then immediately impacts on the contact surface again, whereupon the next recoil follows, but with greatly decreasing amplitude. These oscillations must be suppressed by the control electronics and are transformed into a clear, logical level, which clearly changes only a single time upon a change of the switch position.

[0018] Another algorithm is a switching threshold for a proximity initiator with an analogue output signal, e.g. in dependence on the approach of a body part to the Initiator.

[0019] If the electrical shut-off valve only has the two states "blocked" and "open," then in the simplest case the evaluation of the sensor is only two-stage.

[0020] A multi-stage evaluation of the sensor is appropriate if the electrical shut-off valve permits a plurality of switching states, such as, for example, "half closed."

[0021] Another variant may be the timing of the shut-off valve, that is to say the rapid exchange between "open" and "closed." In this case, however, a possibly increased energy demand must be taken into account.

[0022] Another possible variant, which can be programmed in the hardware and software of the control electronics, is an analogue evaluation of a sensor and an analogue actuation of the shut-off valve. For example, in the case of a relatively large distance of the hands from the sensor on the water faucet of a hand washbasin, the shut-off valve can be only partly opened to keep the water pressure in limits and therefore release only a partial quantity of the maximum possible water stream. Only if the hand is very close to the sensor, and thereby the desire for maximum water pressure is documented, does the shut-off valve open completely.

[0023] For use in sanitary applications, such as, e.g., hand washbasins. bidets and showers, in which the fed water must come into immediate contact with a part of a person, liquid also flows immediately and directly on activation of a sensor.

The end of the flow process is marked by the removal of the human body or his body parts that is located close to the sensor.

[0024] Another variant that can be selected via the software is operation as a toilet flush or as a watering unit. Here, the control electronics must let through a particular amount of liquid on an impulse, that is to say the shut-off valve is automatically switched off after a certain time or after a certain amount measured by the control electronics.

[0025] In further variants, two sensors act on a single shut-off valve or the control electronics are operated by two shut-off valves, e.g. for hot and for cold water.

[0026] In the simplest case of control electronics according to the software, the software and the hardware of the control electronics thus already contain a plurality of partial regions than can be variably adapted to various applications.

[0027] Moreover, a multiplicity of further variants is interesting. It has already been mentioned that the control electronics also have an input for at least one further sensor, of which the signals, like the signals of the first sensor, can also be evaluated by the control electronics and permits adaptation to the respective consumption point. In the simplest case, both sensors act on the actuation of only one shut-off valve.

[0028] In a further variant, the second sensor primarily actuates a second shutoff valve and the software takes care of a connection of the two shut-off valves.

[0029] A flow controller according to the invention is applicable wherever a liquid flows in a line, which ends at a point at which the liquid is intended to develop a particular effect. Interesting applications are in the sanitary area of living rooms and workrooms, such as washbasins, bidets or showers, or other drawing points for water.

[0030] In the sanitary area, tap points for bathtubs are often required to be opened until a particular filling amount has been reached. Another desirable parameter may be the maintenance of a particular water temperature. Variants of this mode of operation are the temperature as a primary setpoint value, on which a particular filling amount is superimposed. Another conceivable variant is the automatic control of the water temperature, on the cooling of which during the use of the bathtub, hot water is additionally admitted when the temperature falls below a particular minimum value.

[0031] Another characteristic requires the closed-loop control of a radiator by a hot-water heating system.

[0032] And yet another characteristic is required for watering a plant or for a beverage dispenser.

[0033] It is common to all applications that a turbine wheel is disposed in the supply line. In a design known for the turbine, the turbine wheel consists of an axle that is rotationally mounted and on which radially outwardly facing guide vanes are arranged. A turbine of this kind is known on a very large some as a Pelton turbine for hydraulic power stations.

[0034] Since, however, the flow controller according to the invention is usually used for liquid lines with very much smaller diameters. It may be more advantageous if the bearing of the turbine wheel is disposed outside the supply line and the drain line on a relatively very large diameter, through which the liquid flows.

[0035] In this case, the turbine wheel is a thin-walled hollow cylinder, which is rotationally mounted on its outer side and which, on its inner side, is fitted with radially aligned guide vanes. These guide vanes can meet one another in the center in a streamlines central body, e.g. a drop-shaped body, which displaces the liquid to the outer region of the pipe cross-section, but, unlike turbines of the prior art, does not contain rotational bearings.

[0036] In a further advantageous variant, permanent magnets are fastened on the outside of such a turbine wheel, which take on the function of the rotor of the electric generator. To this end, stationary electrical coils are disposed at very low distances from the permanent magnet. When the turbine wheel rotates, the permanent magnets move pest at a very low distance from the coils as a result of which their magnetic field permeates the coils. By this means an electrical current is induced in the coils, which can be picked up at the connection terminals of the coil.

[0037] For example in sanitary applications, as sensor, an ultrasound sensor or an infrared sensor or a light barrier can detect the presence of a hand or another body part.

[0038] In sanitary applications, it is appropriate in another interesting embodiment that the control electronics changes the pressure of the emerging liquid by means of a multistage or analogue sensor, in dependence on the registered distance from the body part.

[0039] Another very interesting additional function in the sanitary area is the contact-free closed-loop control of the water temperature at consumption points, for example in open toilets. Here, it is very appropriate if the individual visitors must not directly contact the water faucet, and therefore not, for their part, contaminate it.

[0040] Even if they accidentally knock against the water faucet, the next user is thus not forced to touch the water faucet to initiate a water jet or to adjust the water temperature.

[0041] There are also water faucets that can be initiated contactlessly, in which, however, the adjustment of the water temperature is only possible by contacting and pivoting a lever. That is immaterial, since this selection lever for temperature may again be a source of infection.

[0042] The invention therefore proposes that, in sanitary applications, the control electronics for temperature control according to the invention evaluate the signals of a second sensor, which registers the space outside the consumption point. At a particular place within this space, a body part or an object is introduced, whereupon the control electronics according to the invention change the temperature setpoint. The introduction of the body part into a first edge region can, for example, increase the temperature and the introduction of the body part into a second edge region can lower the temperature.

[0043] The operation of such a contactless temperature actuator is greatly facilitated if an optical or acoustic display acknowledges the temperature setpoint value that is set in each case. A very simple display is a range of light emitting diodes that is distributed over the adjustment range. If the highest temperature is activated, for example, a red light-emitting diode lights up at a boundary of the setting space. If, on the other hand, the lowest temperature is preselected, a blue light-emitting diode lights up at the opposite edge of the setting space. The lighting up of the light-emitting diodes may be the signal that the temperature adjustment has been activated. After a certain time, this display is canceled automatically and thereby reports the readiness to allow a new temperature adjustment to be executed.

[0044] It corresponds to the normal conventions if such a temperature adjustment is oriented parallel to the front side of the person using the tap point. Then it is advisable to arrange

the activation of the highest temperature to the left and the activation of the lowest temperature only at the right-hand side.

[0045] In an alternative embodiment, only a switching function for "increase temperature" and a further switching function for "reduce temperature" may be present.

[0046] However, it is also conceivable for a multiplicity of switching functions to be distributed over the "switch space," so that a particular temperature can be activated as setpoint value by introducing a body part or an object into this space.

[0047] The aforementioned closed-loop temperature control will take place in most cases in that two liquids having temperatures different from one another are mixed. To this end, the closed-loop flow controller according to the invention requires an actuation for two mutually separate shut-off valves.

[0048] Another interesting alternative embodiment is that varying the setpoint value for temperature is passible even when the liquid is not flowing. This variant corresponds to the widely known "single-lever mixers" insofar as the angular position of the controlling lever is transferred to a row of light-emitting diodes or a digital display of the temperature setpoint value.

[0049] A further increase of the comfort of such a closed-loop flow control is the evaluation by a first temperature sensor, which registers the temperature of the supplied hot liquid and the evaluation of a second temperature sensor, which registers the temperature of the mixture. With this second sensor, the control electronics is made capable of automatically re-adjusting the preselected temperature.

[0050] A further increase of the comfort and a significant water saving is achieved with the activation of a circulation line according to requirements: If the supply line for the hot water is so long that it cools significantly between the heat source and the consumption source, the closed-loop flow controller according to the invention can then no longer set a desired temperature setpoint value if the liquid directly behind the shut-off valve for the hot water has cooled below the desired setpoint value.

[0051] An additional function that saves water is a so-called "circulation line," which is only activated when the water behind the shut-off valve, which was originally sufficiently heated, has cooled again. If a start command is given for tapping water with a particular temperature setpoint value that is higher than the temperature of the water currently at the shut-off valve, then the control electronics according to the invention does not at first switch the supply line to the tap point.

[0052] On operation of the water faucet according to the invention in this embodiment, water thus does not emerge at the first moment. Instead, the supply line is connected via an electrically switchable changeover valve to a removing circulation line. This circulation line brings the water that was once hot but has since cooled back to the heater until water with a sufficiently high temperature arrives in the supply line again. Only then does the control electronics switch back the changeover valve for the circulation line and the shut-off valve for the outlet released. Only now does water flow to the consumption point, but with precisely the desired temperature.

[0053] Various designs for the shut-off valves of a flow controller according to the invention are conceivable. In the simplest embodiment, the shut-off valve only has the two positions "open" and "closed." The shut-off valve opens as soon as electrical energy is supplied. When electrical voltage is no longer applied, it is closed again by the force of a spring. This ensures that, even with the failure of the energy, it is never accidentally opened. However, it is disadvantageous that energy is required continuously to hold the valve open.

[0054] The invention therefore alternatively proposes shut-off valves that only require a current pulse to be adjusted to a particular position. Without energy supply, it remains in this position. An undesirable, too-long opening of the valve on failure of the electrical energy supply can be avoided by the fact that the charge state of the energy accumulator is monitored and, if it falls below a minimum value, the shut-off valves is still closed with the "last residue" of the energy.

[0055] Most kinds of turbine wheels are optimized for a particular water pressure at a particular flow velocity. If the operating point falls below this value, for example by a halving of the flow quantity, then the energy quantity generated by the turbine wheel is not only halved but also decreases to a much stronger degree. In the case of drawing of small amounts of water at a slow rate, this can lead to the turbine wheel no longer generating a sufficient quantity of energy to maintain the functioning of the flow controller according to the invention.

[0056] For these cases, the invention proposes, as a variant, that an intermediate container is present, into which the liquid flows always with nominal pressure and nominal velocity. To this end, the access to the intermediate container must be controlled via a shut-off valve that only has the positions "open" and "closed." From the intermediate container, the liquid can also be let out in its very much lower flow velocity by means of a second shut-off valve with various positions. To this end, the turbine wheel always operates in its nominal range and therefore reaches its optimum efficiency. When the intermediate contain is filled, the first shut-off valve must close and then open again when the intermediate container is almost emptied.

[0057] Since the flow controller according to the invention in principle takes its entire energy supply only from the flowing liquid, with repeated drawing of very low amounts of liquid, the energy content of the energy accumulator may fall below a critical minimum level.

[0058] The invention therefore proposes, as an advantageous variant, that the voltage of the energy accumulator is continually monitored by the control electronics. In the event of the voltage of the energy accumulator falling below a particular minimum value, the control electronics opens the shut-off valve automatically and holds it open until the electrical generator has increased the voltage of the energy accumulator back to a particular minimum value or by a particular amount.

[0059] This functionality naturally presupposes that the drawing of a quantity of liquid is possible without risk and at relatively low cost. In the case of a hand washbasin, that would be conceivable in principle. Appropriately, however, the control electronics should make it known by means of a signal, for example, a light-emitting diode or an acoustic alarm, that it will shortly open the water faucet.

[0060] As mentioned above, a closed-loop flow controller according to the invention can also be used for flushing a toilet, in this case, the first sensor of the control electronics is a contact on the cover of a toilet. The turbine wheel is installed in the liquid supply of the flush tank. The shut-off valve is arranged in the outlet line of the liquid from the flush tank.

[0061] If, when the toilet is used, its lid is opened and then closed again, the closing of the cover is the command for the shut-off valve to open for a particular time or for a particular quantity of fluid to flow through. The time span or amount should thus be programmable.

[0062] In a further refinement of this application, the amount of the water used for flushing is automatically adjusted to the disposal task. This purpose could be served by a further sensor, which registers the weight of the mass lying in the toilet bowl. As sensor, a flexible plastic balloon could be used in the depression of the toilet, which adjusts a sensor via a pneumatic line by means of a weight resting on it. With increasing modulation of this sensor and thereby increasing weight of the mass, the amount of the liquid released from the flush tank for flushing is increased.

[0063] An entirely different application of a flow controller according to the invention is a radiator. In principle, that is usually a metal hollow body through which heated liquid flows. The through-flowing liquid amount emits the heat stored in it through the walls of the radiator to the room to be heated.

[0064] A flow controller according to the invention is applicable as temperature controller. A temperature sensor must register the temperature of the room to be heated. Below a minimum temperature that is adjustable at the control electronics the electrical shut-off valve is opened such that heated liquid flows through the radiator and heats the surroundings. As soon as the temperature sensor registers that the room temperature has risen to a second maximum value, which is adjustable at the control electronics, the control electronics closes the shut-off valve again.

[0065] Appropriately, the externally adjustable temperature setpoint value should lie between these two extremes. The switch stroke determined by the interval between the minimum temperature and maximum temperature should generally only be chosen when the flow controller is put Into operation, but not adjusted during continuing operation.

[0066] A further, appropriate additional function of a heating controller is the possibility of a general lowering of the temperature setpoint value of particular times of day, e.g. the so-called night lowering—or for particular weekdays, that is to say for predictable work-free days in office rooms. If the opening of windows or doors can be registered, e.g. by means of a contact, which the control electronics of the flow controller according to the invention continually evaluates, a heat loss during ventilation can be reduced by switching off the heating.

[0067] Another, very interesting application area of a flow controller according to the invention is monitoring the watering of at least one plant in the soil or another substrate. To this end, the first sensor of the flow controller must be a moisture sensor and the liquid must be suitable for watering the plant, that is to say provided with suitable nutrients and fertilizers as required.

[0068] The moisture sensor continually measures the moisture in the soil or in the substrate. If the value falls below a preselected minimum value, the flow controller opens the shut-off valve. If the moisture sensor responds sufficiently rapidly, it can terminate the liquid supply itself when a maximum value for the moisture has been reached.

[0069] If, however, the time delay between the application of the liquid on the soil and the registration by the liquid sensor is very large, the control electronics should emit a determined amount of liquid, which is preselected when it is put into operation.

[0070] Thereafter, a pause should be inserted in the cycle for the evaluation of the liquid sensor, which corresponds at least to the average time taken by the liquid to penetrate as far as the liquid sensor.

[0071] Another, very interesting application of a flow controller according to the invention is the automatic filling of an arbitrary vessel, which is to be filled with a liquid. For this embodiment, the invention proposes that, at the end of the supply line, a U-shaped end piece is disposed, which can be mounted on the edge of the vessel. The first sensor is arranged on this U-shaped end piece such that it is activated by the mounting of the end piece on the edge of the vessel. Thereupon the control electronics opens the shut-off valve such that the feed of liquid begins.

[0072] For the closing of the shut-off valve in good time, there must be mounted on the aforementioned end place a second sensor, which registers that the level of the liquid has reached a particular distance from the edge of the vessel. When the second sensor transmits this signal to the control electronics, the latter switches the shut-off valve on again.

[0073] This second sensor may be, for example, an ultrasonic sensor. Another, very simple embodiment comprises two electrodes, which register the conductivity of the liquid. Another variant is a fork light barrier. Even in the case of clear liquids, vortices and air bubbles form on the surface, which can be registered by this fork light barrier.

[0074] As an alternative embodiment, further electrical consumers can be connected to the energy accumulator, such as, for example, lighting elements and/or heaters and/or other electrical devices. It goes without saying that this dimensioning of the electrical generator and the liquid pressure necessary for its operation and the necessary liquid amount must be adapted to the consumer.

[0075] In a further very advantageous application of a flow controller according to the invention, the turbine wheel and the shut-off valve are disposed in the outflow line of a central water reservoir of a watering system. The turbine wheel and the electrical generator are dimensioned so large that, besides the shut-off valve, further electrical consumers can be operated, such as for example, lighting elements or heating for plants to be watered.

[0076] If the central water reservoir is emptied during the day, it can be refilled at night with inexpensive night power. Since the water reservoir is geometrically higher than the surfaces to be watered, energy stored therein is available, which has already been generated with relatively inexpensive night power. This energy can be called up at any time of the day, even during day hours, when the electrical energy from the power grid is otherwise considerably more expensive.

[0077] Whenever watering is carried out, the electrical generator is also activated thereby and generates electrical energy. This energy can be used, for example, for heating and illuminating plants in greenhouses. And which is also still very low on days In spring or autumn, when the weather is still very cloudy and/or the exterior temperature is still very low.

[0078] This configuration is particularly advantageous if, in addition to the flow controller according to the invention, the watering is switched over from distribution of the water by squirting or spraying with high pressure to a drop-by-drop supply of the water with direct lines to the plants.

[0079] The crucial advantage of the flow controller according to the invention is that the proportion of the mechanical energy that is stored in the central water accumulator, which had previously been "wasted" for spraying the water, is, instead, converted into electrical energy that can be used again for other purposes. By this means, an additional lighting or heating of the plants is possible, which, compared to the previous configuration, does not cause significant extra expenditure of operating costs.

[0080] Further details and features of the invention are explained below in greater detail with reference to an example. However, this is not intended to limit the invention but only to explain it. In schematic view:

[0081] FIG. **1** shows a cross-section through a flow controller in a water faucet on a wash basin

[0082] FIG. **1** shows a "water faucet" on the edge of a wash basin in cross-section. At the right-hand portion, the columnar housing of the water faucet can be seen, in which the supply line **1** is integrated. It can be seen how this supply line **1** is connected downwardly to a supply having the liquid **2**. FIG. **1** shows very clearly how, in the supply line **1**, the liquid **2** rises as far as the shut-off valve **6**. In the embodiment shown here, it is a washer, which is pushed by a hard plate onto an opening in the water faucet. For electrical actuation of the shut-off valve **6**, there serves an actuator **61**, which is illustrated in greater detail in the figure.

[0083] In FIG. **1**, it can be clearly seen that the gasket of the shut-off valve **6** must be raised up to release the passageway for the liquid **2**. From there, the liquid then flows further through the approximately horizontal arm as far as the outlet of the illustrated water faucet.

[0084] In the illustrated embodiment, an electrical generator **4** is mounted on the turbine wheel **3**, the essential components of which are the permanent magnet **41** on the rotating portion of the electrical generator **4** and the coils **42** in the stationary portion of the electrical generator **4**.

[0085] In the section of FIG. **1**, it can be readily seen that the permanent magnet **41** is mounted on a sleeve, which accommodates the turbine wheel **3** in Its interior. Since the front portion of the cylindrical sleeve has been removed in the drawing, the connecting surfaces of the four vanes **31**, which face the viewer, of the turbine wheel can be clearly seen behind. These vanes **31** bear a streamlined displacement body in the center of the turbine wheel.

[0086] This streamlined body only serves to displace the liquid stream to the outer region of the guide vanes, where the lever arm is sufficiently long with respect to the axis of rotation to generate a torque. In departure from water turbines of the prior art, the bearings of this turbine wheel, however, are disposed on the sleeve, which contains the turbine wheel. For this application case, the invention proposes sliding bearings, since they are surrounded by the liquid stream. In the illustrated embodiment, two annular sliding bearings are provided, which are recognizable as cross-hatched rectangles in the section of FIG. **1**. These sliding bearings are the bearings both for the electrical generator **4** on the outside as well as for the turbine wheel **3** on the inside of the two sliding bearings.

[0087] In FIG. **1**, it can be clearly seen how the connection cable **43** is led from the coil **42**, in a hollow space through the approximately horizontal portion of the water faucet, into its tower-like, perpendicular portion.

[0088] There, the control electronics **7** is installed in a hollow space, which can be clearly seen in FIG. **1** as an electronic circuit board, which is shown as a section in the drawing. The two sensors **81** are also wired to this electronic circuit board **7**. In the illustrated exemplary embodiment, the first sensor **81** consists of two portions, namely a transmitter and a receiver. If the pulses or rays emitted by the transmitter are reflected by a body below the outlet of the liquid **2**, this signal can be received by the second portion of the first sensor **81**, whereupon the control electronics **7** releases the actuation **61** of the shut-off valve **8**. In FIG. **1**, the cable **82** for electrical connection to the actuation **61** can be clearly seen at the top on the water faucet.

[0089] In FIG. **1**, in the hollow space of the vertical portion of the water faucet, there is installed the energy accumulator **9**, of which the two poles are connected to the control electronics **7**, so that the charging and discharging of the energy accumulator **9** can be monitored from there.

[0090] In FIG. **1**, an integrated module can be seen, consisting of the turbine wheel **3** in the sleeve, with the sliding bearings mounted thereon, and the permanent magnet **41**, which is also mounted externally on the outside of the sleeve around the turbine wheel, as well as the coils **42** as stationary portion of the electrical generator **4**.

[0091] In FIG. **1**, it can be clearly seen how the outer housing of the head of the water faucet, which is also the holder of the coils **42**, is screwed into the horizontal arm of the water faucet by means of a screw thread. The step-by-step sequence of assembly can also be readily understood in FIG. **1**: It begins with the Outer housing, which is then followed by the upper sliding bearing of the coils, then the sleeve together with the inner turbine wheel, the permanent magnet, which if fastened on the outside, and the coils, which lie thereon, and subsequently the lower sliding bearing and finally the lower terminating ring, which fixes the coil body in the outer housing and is also the support for the lower sliding bearing.

[0092] Together with the surrounding housing, a module is thus created, which can also be used in entirely different applications. The electronic circuit board, too, can also be used in other modules. Only the lead-in for the sensors that are used in each case is to be matched to the special features of each application case, for which purpose software, which can be called up on the electronic circuit board, and optional hardware is present.

LIST OF REFERENCE CHARACTERS

[0093] **1** Supply line for the liquid **2**

[0094] **2** Liquid, drives the turbine wheel en route to the consumption point **5**

[0095] **3** Turbine wheel, driven by liquid **2**, drives the electrical generator **4**

[0096] **31** Vanes of the turbine wheel **3**

[0097] **32** Bearings of the turbine wheel **3**

[0098] **4** Electrical generator, charges the energy accumulator **9**

[0099] **41** Permanent magnet on the rotating portion of the electrical generator **4**

[0100] **42** Coils, in the stationary portion of the electrical generator **4**

[0101] **43** Connection cable of the coils **42**

[0102] **5** Consumption point **5** for the liquid **2**

[0103] **6** Shut-off valve, controls the flow of the liquid **2**

[0104] **61** Actuation of the shut-off valve **6**

[0105] **62** Cable for actuation **61**

[0106] **7** Control electronics, controls shut-off valve **6**

[0107] **81** First sensor, evaluated by control electronics **7**

[0108] **82** Second sensor, evaluated by control electronics **7**

[0109] **9** Energy accumulator, can be charged by electrical generator **4**

1. Flow controller for liquids having an energy supply by means of the flow of said liquid, consisting of:
- a supply line for the liquid and
- a turbine wheel,
- which is rotationally mounted and
- through which the liquid can flow, and
- which drives an electrical generator, which charges an energy accumulator and
- a consumption point for the liquid, characterized in that
- transmission of the liquid can be blocked by a shut-off valve,
- which can be electrically actuated by control electronics,
- which is evaluated by at least one sensor, and
- which can be adapted to various types of sensors and the characteristics of different types of consumption points, and
- the shut-off valve and control electronics and sensor can be supplied with electrical energy by the energy accumulator.

2. Flow controller according to claim **1**, characterized in that the control electronics has at least one input for a second sensor, of which the signal
- can be evaluated by the control electronics and
- can be taken into account in the adaptation to the consumption point in each case during actuation of the shut-off valve.

3. Flow controller according to claim **1**, characterized in that the consumption point is
- a washbasin or
- a toilet flush
- a shower or
- a bathtub or
- another sanitary object or
- a radiator or
- a cooling element or
- another temperature-control device or
- a beverage dispenser or
- another liquid discharge or
- a plant to be watered or
- another agricultural or forestry device.

4. Flow controller according to claim **1**, characterized in that the turbine wheel is a thin-walled hollow cylinder,
- which is rotationally mounted on its outside and
- which is equipped on its inside with radially oriented guide vanes.

5. Flow controller according to claim **1**, characterized in that there are fastened on the outside of the turbine wheel permanent magnets.
- which are disposed at very low distances from the stationary electrical coils and
- thereby emit an electrical current when the turbine wheel is rotated.

6. Flow controller according to claim **1**, characterized in that for sanitary applications
- an ultrasound sensor or
- an infrared sensor or
- a light barrier
- registers the presence of a hand or another body region.

7. Flow controller according to claim **1**, characterized in that, for sanitary applications, the control electronics, by means of a multistage or analogue sensor, changes the pressure of the outflowing liquid in dependence on the distance from the body part that is perceived as nearest.

8. Flow controller according to claim **1**, characterized in that, for sanitary applications, the control electronics, registers the signals of a second sensor for temperature control,
- the second sensor registering a space that is located outside the consumption point and
- the ingress of a body part and/or an object into a first edge region of the space increases the temperature and
- the introduction into a second edge region of the space reduces the temperature.

9. Flow controller according to claim **8**, characterized in that the temperature is varied by mixing two liquids with temperatures that differ from one another in each case.

10. Flow controller according to claim **8**, characterized in that the varying of the setpoint value for the temperature is also possible without flow of the liquid.

11. Flow controller according to claim **1**, characterized in that the setpoint value and/or the actual value for the temperature can be indicated by means of a display, for example in stages or as a numerical value.

12. Flow controller according to claim **8**, characterized in that the control electronics evaluates a second sensor as temperature sensor, and regulates the temperature in dependence on this measurement and the set temperature setpoint value.

13. Flow controller according to claim **1**, characterized in that:
- the supply line for the hot liquid can be changed over by the control electronics to a removing circulation line
- on the start command for a supply of liquid to the consumption point, a second sensor registers the temperature in the supply line and
- the control electronics only releases the supply to consumption point and blocks the circulation line when the temperature setpoint value has been reached.

14. Flow controller according to claim **1**, characterized in that the shut-off valve can be shifted by means of a current pulse in each case into a particular position and remains in this position without energy supply.

15. Flow controller according to claim **14**, characterized in that the shut-off valve only has the two positions "open" and "closed."

16. Flow controller according to claim **1**, characterized in that the liquid flows through a first shut-off valve, which is disposed in the vicinity of the turbine wheel and which only has the positions "open" and "closed" and the liquid flows from there into an intermediate vessel, of which the outlet can be closed by means of a second shut-off valve with a plurality of positions.

17. Flow controller according to claim **1**, characterized in that the voltage of the energy accumulator can be monitored by the control electronics and if the voltage of the energy accumulator sinks below a particular minimum value, the control electronics opens the shut-off valve and keeps it open until the electrical generator has increased the voltage of the energy accumulator by a particular amount.

18. Flow controller according to claim **1**, characterized in that the sensor is a contact on the cover of a toilet, which can be registered by the control electronics and the turbine wheel is installed in a supply line of the flush tank and the shut-off valve is disposed in the outlet line of the liquid from the flush tank and after the cover of the toilet has been closed, the shut-off valve is opened for a particular time or until a particular liquid amount has flowed through.

19. Flow controller according to claim **18**, characterized in that, by means of a further sensor, the weight of a mass lying in the toilet bowl can be registered, which can be evaluated by the control electronics and, with increasing mass, the amount of the amount of liquid that is outlet from the flush tank for flushing is also increased.

20. Flow controller according to claim **1**, characterized in that, in the case of a consumption point, as a radiator that is to be heated or cooled by means of liquid, the sensor is a temperature sensor and

below a settable minimum temperature, the shut-off valve can be opened and

remains open until an adjustable maximum temperature has been reached and

a temperature setpoint value, which lies approximately midway between these two extremes, can be externally entered into the control electronics.

21. Flow controller according to claim **10**, characterized in that the control electronics varies the temperature setpoint value in dependence on the time of day and/or the day of the week and/or the opening of windows and/or doors.

22. Flow controller according to claim **1**, characterized in that:

the consumption point is at least one plant in the soil or in another substrate and

the sensor is a moisture sensor and the liquid serves for watering the plant.

23. Flow controller according to claim **1**, characterized in that:

the consumption point is a vessel that can be filled with the liquid and

the supply line has a U-shaped end portion that can be mounted on the edge of the vessel and

the first sensor is disposed on the U-shaped end portion and

during mounting of the end portion on the edge of the vessel, the shut-off valve can be opened by the control electronics and

the second sensor is also disposed on the end portion and

registers the fact that the level of the liquid has reached a particular distance from the edge of the vessel and

at this level, the shut-off valve can be closed by the control electronics.

24. Flow controller according to claim **1**, characterized in that the control electronics is disposed on a circuit board, which can be formed into a hollow cylindrical segment or into a polygonal hollow column.

25. Flow controller according to claim **1**, characterized in that further electrical consumers can be connected to the energy accumulator or to the control electronics and supplied, such as, for example:

lighting elements and/or

heating and/or other electrical equipment.

26. Flow controller according to claim **1**, characterized in that the turbine wheel and the shut-off valve are disposed in the outflow line of a central water accumulator of a watering system and the turbine wheel and the electrical generator are dimensioned so large that, besides the shut-off valve, further electrical consumers can be operated, such as, for example, lighting elements or heating for plants to be watered.

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