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(54) DRAIN VALVE, A METHOD AND USE THEREOF

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Description

Field of the Invention

[0001] The present invention relates to a drain valve according to claim 1 configured for sanitary elements without overflow. The drain valve comprises a plug, a drain flange, a fastening unit and a drain valve inner surface. The drain flange is adapted for being arranged through an evacuation hole in a sanitary element. It furthermore relates to the use hereof and methods for disinfecting drain valves to eliminate the build-up of bacteria and other germs.

Background of the Invention

[0002] Fouling in drains where wastewater flows directly into the drain from the sanitary elements may be the cause of unpleasant or even unhealthy effects. The fouling may be deposited in the drain and remain in the empty drain long after the flow of wastewater has ended. The fouling may include germs such as bacteria, viruses, mould, fungi or spores which may give off unpleasant odours, transmit infections, cause allergies, trigger asthma attacks or cause other unhealthy effects. Furthermore, the fouling may spread into the sanitary element from the drain.

[0003] In hospitals and other sensitive areas, the fouling in drains is a comprehensive problem, which many places is handled by for example using the plug to close off the plughole in washbasins when it is not in use, and thus mechanically closing off the drain to reduce the spreading of germs.

[0004] Especially the first part of the drainage system comprising the drain valve arranged in an evacuation hole of a sanitary element is difficult to clean with cleaning agents. The drain valve typically comprises a drain flange with a sieve, especially if the drain valve includes a plug. The sieve precludes any mechanical cleaning of the part of the sieve facing away from the sanitary element and towards any connected drainage piping further down the line. Furthermore, the part of the drain valve located below the sieve is also precluded from any mechanical cleaning without dismantling any connected drain pipes.

[0005] Previous suggestions for reducing the spreading of germs in plumbing installations have included various heat and electrical treatments including ultraviolet (UV) treatment of the wastewater. The methods have often included treating the wastewater in a chamber or U-bend further down the drainage pipe. US6666966B1 discloses such a device. However, this does not eliminate spreading of germs from the fouling deposited in the drain above the wastewater treatment.

[0006] In general, UV light is broadly used in water treatment for cleaning and disinfection purposes, and includes amongst other treatment of process water, waste water and drinking water. A device configured for UV-treatment in a drain system for disinfecting water by killing germs is disclosed in DE420691A1 wherein the disinfection unit comprises a UV source as a germ-killing device in a treatment zone, which UV source effects at least a part of the water in a U-bend and which treatment zone is within the U-bend itself. However, using UV-treatment for disinfecting water requires a large effect compared to UV-treatment for disinfection in air. And as described above placing the treatment zone within the U-bend does not eliminate spreading of germs from the fouling deposited in the drain above the treatment zone.

[0007] UV light with a wavelength of 253.7 nm (254 nm) is often referred to as Germicidal UV, as it is used for killing germs. Germicidal UV has been used safely and effectively in hospitals, clinics and laboratories for more than 60 years. The UV light destroys or alters the DNA of microbial contaminants causing malfunctioning in cell replication and leads to cell death. If microbes are irradiated with enough dosage of germicidal UV, they can no longer reproduce and will thus over time disappear from the indoor environment.

[0008] Germicidal UV systems are suggested for keeping indoor environments healthier by keeping HVAC systems clean. The coils and air ducts of HVAC systems often are the breeding grounds for pathogenic bacteria and allergenic and toxic fungal contaminants that can cause allergies, asthma and other respiratory problems. These systems require specialized filtering systems in combination with the UV systems to avoid spreading of particles due to the airflow in such systems contrary to disinfection systems of drains.

[0009] Two other systems for disinfection of drains are disclosed in WO02081829A1 and DE29807712. Both systems comprise housings with a single UV source and are operated above the water surface of the wastewater. Both devices are configured for establishing a cross sectional UV-trap in the drain by using a curved housing for confining the UV light. WO02081829A1 uses a pulsed light source comprising a small percentage of UV-light with a wavelength above 200 nm, whereas DE29807712 is configured with a continuous UV-C light source. However, both systems has the drawback of being mountable at a distance below the drain valve and in combination with the focused cross sectional UV-trap, the part of the drainage system above the UV tap and especially the sieve at the top part of the drain is not being disinfected. Especially the sieve and the part of the drain adjacent hereto is an essential source of bacteria and biofilm due to limited accessibility both mechanically and with chemicals. WO10081479 A2 on the other hand specifically discloses a drain valve with an improved sealing mechanism to achieve for an easily installed drain valve and a drain valve wherein the interface between the drain valve and the drain opening may be easily cleaned. However, the for cleaning the disclosed drain valve the part comprising the sieve shall be manually dismantled and cleaned frequently for eliminate spreading of germs from any fouling deposited in the sieve and on the drainage surface of the drain valve.

[0010] WO02081829A1 discloses a device for decontaminating U-bends consisting of a flash lamp arranged at the periphery of the zone to be made secure between the U-bend and the discharge of the washbasin and capable of generating photonic pulses of UV rays in order to create a zone free of micro-organisms. The device is designed to prevent the movement towards the washbasin of micro-organism in the form of a potentially pathogenic biofilm. The device, however, is difficult to mount and it fails to disinfect the plug and the drain flange of the sink under which the device is attached.

[0011] DE 4206901A1 discloses a device for disinfecting water in U-bends. The device is, however, not able to disinfect the upper areas of the drain pipe connected to the sink. Accordingly, this solution is not capable of disinfecting the plug and the drain flange of the sink under which the device is attached. Further similar valves according to the state of the art are disclosed in US 2010/303679A1, DE102009042212A1, DE102015006278A1, US7900288B2, DE4224445A1, WO2009/024155A1 and US6797127B1.

Object of the Invention

[0012] It is an object of this invention to overcome one or more of the aforementioned shortcoming of the prior art. One object of this invention is to obtain a drain valve to be mounted in any sanitary elements such as sink, kitchen sink, bathtub etc. or other units where water flows directly into a drain. Another object is to obtain a method for disinfecting a drain valve while mounted in a sanitary element to eliminate the build-up of bacteria and other germs.

Description of the Invention

[0013] The aforementioned aspects are achieved by a drain valve according to claim 1 for continuous disinfecting a drain valve configured for sanitary elements without overflow, said drain valve comprising a plug, a drain flange, a fastening unit, a drain valve inner surface and a drain valve outer surface, said drain flange is adapted for being arranged through an evacuation hole in a sanitary element.

[0014] The fastening unit is configured as a disinfection unit comprising a first pipe connection, a second pipe connection, a UV-translucent tube and a housing.

[0015] The first pipe connection is configured with an inlet and an internal thread.

[0016] The second pipe connection is arranged with an outlet.

[0017] The UV-translucent tube is arranged in between the first and second pipe connection, so that the pipe connections and the UV-translucent tube are located in extension of each other to form a channel with an inner surface in order for liquid to flow through the fastening unit from inlet to outlet.

[0018] The housing is configured with an inner wall, wherein the inner wall comprises the UV-translucent tube, which housing comprises a chamber having a larger extension in radial direction than the pipe connections and an annular area in which annular area a continuous mode UV source is arranged. Hereby, a central area with an outer periphery defined by the UV-translucent tube is continuously exposed to UV light.

[0019] The first pipe connection is adapted to be screwed onto the drain flange below the sanitary element to fasten the drain flange to the sanitary element.

[0020] The drain flange and the plug are adapted to be interconnected in a fixed open position.

[0021] One effect of this embodiment may be that UV light is emitted into the central area and thus the inner surface of the channel in the drain valve is continuously illuminated with UV light thereby achieving a continuously disinfection process of the channel by eliminating germs and/or fouling on the inner surface.

[0022] A further effect is that the use of cleaning agents and/or chemicals may be significantly reduced by using UV light. This may be advantageous in regard to reducing the risk of germs and bacteria developing resistance towards these chemicals, as the germs and bacteria are killed by destroying their DNA, which is independent of any development in resistance. A further advantage is that this drain valve may be a sustainable solution. Yet a further advantage may be environmental effects such as reduced pollution of the water environment and reduced exposure to chemicals for the cleaning staff.

[0023] Wastewater flowing through a drain may deposit fouling or sediment on the interior side of the drain. The fouling or sediment may include germs such as bacteria, viruses, mould, fungi or spores. The germs may spread or diffuse from the drain up into the sanitary elements or any surface comprising an inlet of the drain. This may give off unpleasant odours, transmit infections, causing allergies, trigger asthma attacks or cause other unhealthy effects. The fouling and sediment remains after the flow stops and thus a further effect of the embodiment is that the empty drain may be illuminated and thus disinfected. This may be advantageous in regard to that the UV exposure required for eliminating germs in air is much lower than the exposure required for germs in a liquid solution. The level of UV exposure required depends on which germs to eliminate.

[0024] Sanitary elements are used as a general term to cover elements such as washbasins, sinks, kitchen sinks, bathtubs as examples, but in no way limited to these but including elements/installations where water flows into a drain.

[0025] Plumbing installations are also used as a general term to cover sanitary elements and the drainage systems connected thereto or drainage systems in general.

[0026] Two typical bacteria which are relevant for the use of this embodiment are the E coli and the Legionella bacteria. To achieve a killing or inactivation percentage of E coli bacteria of 90% a UV exposure in the order of

45 J/m^2 is required rising to 103 J/m^2 for achieving an increased killing or inactivation percentage of 99.9 %. For Legionella bacteria the respective UV exposures are in the order of 15 J/m^2 and 31 J/m^2. These are only two examples of relevant bacteria and the disinfection is by no means limited to these two species.

[0027] Using a continuous UV emitting source has the effect that the channel of the drain valve is continuously exposed to UV light. This is the case both when water flows in the drain and for the empty drain. This may be advantageous in regard to reducing the risk of germs from lower parts of the drain spreads past the drain valve and into the sanitary element - like establishing a UV fence or trap. Due to the low effect required for the UV expose the continuous mode may be sufficient cost effective. Furthermore, the UV source does not require regular turn on/off events, which, depending on the source, may be time- and energy consuming.

[0028] A further effect of the embodiment may be that the second pipe connection may be of any given standard and size thereby achieving that the drain valve may fit to existing drain systems and standard parts used in plumbing installations.

[0029] In one embodiment of the drain valve, the fastening unit is configured to spread the UV light beyond the fastening unit out through the inlet and outlet.

[0030] One effect of this embodiment may be that the emitted UV light may spread into the first and second pipe connections and further illuminate their inner surfaces. Furthermore, the emitted UV light may spread beyond the fastening unit to illuminate further parts of the drain valve, which may include all the parts of the inner surface being inside the drain valve and facing the disinfection unit.

[0031] A further effect may be that the emitted UV light may even illuminate parts connected to the drain valve such as sanitary elements and/or connected drain piping. This may be advantageous in regard to achieving an even more extensive and thorough disinfection of the plumbing installation. This may be especially advantageous in regard to reducing the risk of unpleasant odours, spreading and transmitting infections, cause allergies, trigger asthma attacks or other unhealthy effects. Furthermore, the fouling may be prohibited to spread into the sanitary element from the drain.

[0032] The plug covers the plughole and may add an extra security precaution for avoiding UV exposure by ensuring that the UV light do not expose anyone working at the sanitary element as UVC light may be harmful to the human eye above a given level of exposure.

[0033] In one aspect the drain valve comprises gaskets that fit directly onto the drain valve for a leakage proof connection to the sanitary elements and to a drainage system.

[0034] In one aspect the UV source may comprise a UV tube/lamp and a starter, where the UV tube/lamp is connected to the starter.

[0035] In one aspect the UV source may comprise only a UV tube/lamp. The UV tube/lamp may be further connected to a starter.

[0036] In one aspect the UV tube/lamp may have any shape enclosing an open central area. The shape may be round, polygonal such as squared, rectangular, triangular, pentagonal or a combination of these amongst others. These are only examples and the shape of the UV tube/lamp is by no means limited to this.

[0037] In one embodiment of the drain valve, the parts forming the drain valve outer surface are made of one or more materials, which are opaque to UV light.

[0038] One effect of the embodiment is that that emitted UV light from the UV source may be contained inside the fastening unit only spreading out through the pipe connections depending on the intensity of the light, thereby achieving that the UV light may be confined to expose only a limited area in the disinfection unit and possibly the drain. UV light may have damaging effect on humans and thus the exposure to UV light should be avoided. This may be achieved by this embodiment.

[0039] In one embodiment of the drain valve, the UV source emits UV light with a wavelength in the range of 100 nm to 400 nm, preferable in the range 200 nm to 280 nm, even more preferably in the range 240 nm to 260 nm.

[0040] UV light generally covers the wavelength region from 100 nm to 400 nm. UV light is generally split into a number of regions as listed here:

400nm - 315nm: UV-A - Blacklight UV
315nm - 280nm: UV-B - Dangerous UV
280nm - 200nm: UV-C - Germicidal Ultraviolet at 254 nm (253.7 nm)
200nm - 100nm: UV-V - Vacuum UV
UV-V light may have the additional effect, that ozone may be created by the source, thereby achieving additional disinfection.

[0041] One effect of this embodiment is that the UV source may emit UV light comprising the UV-germicidal wavelength and a range around this wavelength. The germicidal UV is used for killing germs as the Germicidal UV causes alterations in the DNA structure of microbial contaminants which leads to cell death due to malfunctioning in the cell replication. Thus using a UV source emitting light including UV Germicidal achieves an effective disinfection unit. The UV source may emit a broad UV spectrum covering UV-C or even UV-A, UV-B, UV-C and/or UV-V. The advantage of using a broad spectrum UV source may be that a broader range of harmful effects may be achieved. Another advantage may be that the availability of UV sources with applicable specifications is increased - this may include parameters such as price, shape, exposure, lifetime amongst others.

[0042] The four regions of UV light have different effects on the surroundings. Some of these regions or parts of them are part of the natural sunlight, while other wavelengths require special UV tubes/lamps where sufficient intensity/exposure may be a challenge.

[0043] UV-A - Long wave UV causes tanning and premature skin aging.

[0044] UV-B - A small, but dangerous part of sunlight. Most solar UV-B is absorbed by the ozone layer. Prolonged exposure causes sun burn and could result in unhealthy effects on the skin and eyes.

[0045] UV-C causes skin redness and eye irritation, but may not cause skin cancer or cataracts. UV-C includes Germicidal ultraviolet - UV light of 253.7 nanometers wavelength.

[0046] In general, people should never look at the UV light, and the electric power to the UV systems should always be turned off when replacing or cleaning ultraviolet lamps.

[0047] In one embodiment of the drain valve, the housing comprises multiple parts such that the fastening unit can be disassembled for maintenance and service.

[0048] One effect of this embodiment may be that the housing may be dismantled to repair and maintain the unit.

[0049] The parts constituting the housing may include appropriate gaskets to achieve a leakage proof unit.

[0050] The size and shape of the housing and the UV source may be arranged to fit a given purpose.

[0051] In one embodiment the drain valve further comprises a cassette made of a high-reflective material for UV light. The cassette is mountable in the annular area inside the chamber and is configured for partly surrounding a UV source, such that the emitted UV light is directed towards the UV-translucent tube.

[0052] High reflective materials may include materials which are high reflective for UV light such as Aluminum. Alternatively, the cassette may be made of other materials with a high reflective coating on the surfaces facing the UV source.

[0053] One effect of this embodiment is to ensure a high level of UV light being directed towards the UV-translucent tube to optimize the amount of UV light entering the channel and spreading within the channel.

[0054] Another effect is that the chamber may be made of materials which are not UV reflective but has other properties suitable for drain valves such as stainless steel. Using a cassette for surrounding or partly surrounding the UV source may therefore ensure a higher level of UV light being directed towards the UV-translucent tube, thereby optimizing the amount of UV light entering the channel and spreading within the channel.

[0055] In one embodiment the drain valve comprises multiple UV sources arranged on top of each other in a direction along the channel, such that each UV source surrounds or partly surrounds the UV-translucent tube, where the UV sources are arranged in an descending order according to the emitted wavelengths with the UV source emitting UV light with the shortest wavelength placed closest to the outlet, and where each UV source is separated from each other by a part of a cassette, such that the UV sources are not directly exposed to UV light emitted from an adjacent UV source.

[0056] One effect of this embodiment is that UV sources with specific wavelength ranges may be chosen to achieve customized drain valves for specific purposes. When using multiple UV sources these should preferable be prohibited from illuminating each other with high intensity as this may otherwise cause degradation of the UV lamps/tubes leading to reduced lifetime of the UV lamps/tubes.

[0057] UV-V may create ozone in the air. Contrary hereto higher wavelength UV light may break the oxygen bonds in an ozone molecule, especially UV-C light.

[0058] The UV sources may therefore be arranged such that any UV-V emitting UV source is arranged such the any ozone is created furthest away from the sanitary unit such that any UV sources with higher wavelengths may illuminate any ozone created. Thereby it may be achieved to have a drain valve which also produces ozone, which adds further disinfection effects to the use of the drain valve without causing ozone exposure for the user of the sanitary element.

[0059] In a further embodiment the drain valve comprises two UV sources, where a first UV source has a wavelength in the range of 200 nm to 280 nm, preferably in the range 240 nm to 260 nm and a second UV source has a wavelength in the range of 140 nm to 200 nm, preferably in the range 170 nm to 190 nm.

[0060] This embodiment uses UV-V light and UV-C light and may have the effects described immediately above of combining Ozone with the Germicidal UV light for enhanced disinfection.

[0061] In one embodiment of the drain valve, the parts forming the inner surface of the channel are made of materials with a given hardness, such that the inner surface is not scored by lime or other particles found in household drainage water.

[0062] In one embodiment of the drain valve, the parts forming the inner surface of the channel comprise a flush inner surface.

[0063] The UV-translucent tube may a standard Quartz tube with a sufficient hardness and a refractive index allowing UV-light of a given wavelength interval to be transmitted.

[0064] As an example the UV-translucent tube may be transmissible for UV light within a wavelength interval of 180-300 nm. As another example the UV-translucent tube may be transmissible for UV light within a wavelength interval of 220-300 nm.

[0065] As an example the UV-translucent tube may be a clear electrically fused quartz and the tube may be machine-drawn.

[0066] One effect of this embodiment may be to reduce wear and tear on the UV-translucent tubes resulting in a rough surface in the channel - the channel inner surface. A rough surface of the UV-translucent tube may cause scattering of the UV light back into the chamber. By reducing the wear and tear on the surface of the UV-translucent tube a high transmittance of UV light through the UV-translucent tube may be maintained for an optimal

amount of UV light entering the channel and possibly spreading within the channel.

[0067] A rough surface of the UV-translucent tube may furthermore cause limescale to be deposited and build-up on the inner surface thereby preventing UV-light from transmitting into the central area and the channel.

[0068] Another advantage may be to maintain the strength of the UV-translucent tube for optimal lifetime.

[0069] In one embodiment of the drain valve, the housing comprises a power connection accessible from the outer surface.

[0070] The effect of this power connection is that the disinfection unit may be installed in the plumbing installation while being disconnected from power. This is advantageous in regard to reducing the risk of exposure during installation. A further advantage is that the disinfection unit may be connected to any relevant power source after it is mounted in the plumbing installation. This also achieves for that the power source may be changed in case the power supply from one power source malfunctions. The power connection may be a plug, a socket, or a cable - these are only examples and the power connection is by no means limited hereto.

[0071] In one embodiment of the drain valve, the plug is configured with a plug cleanable surface without cavities. The plug cleanable surface is a part of the plug's outer surface being placed inside the drain valve and/or facing the disinfection unit, such that the plug cleanable surface is illuminated by the emitted UV light.

[0072] Similar to the sieve the plug in drain valves are generally difficult to clean manually because they comprise cavities wherein fouling and germs may build up. The cavities in the plugs are often necessary due to the design of the drain valve especially for closable drain valves.

[0073] The removal of fouling and germs generally requires mechanical cleaning, which is especially difficult in small cavities. This is often the case for plugs in drain valves.

[0074] An effect of the embodiment may therefore be an easier cleanable plug surface.

[0075] An object of the invention is achieved by a method according to claim 12 for disinfecting a drain valve inner surface using a drain valve.

[0076] One effect of the method may be that the germs on the channel inner surface are continuously eliminated thereby achieving that the spreading of germs in that area is prevented or at least greatly reduced.

[0077] The effects and advantages achieved by this method are in line with the previously described effects and advantages achieved by the embodiments of the drain valve.

[0078] Furthermore, an object of the invention may be achieved by a method for mounting a sanitary element with a drain valve in line with the above described embodiments comprising acts of:

- providing a sanitary element;
- placing the drain flange of the drain valve through an evacuation hole in the sanitary element;
- screwing the fastening unit of the drain valve onto the drain flange below the sanitary element to fasten the drain flange to the sanitary element, and
- interconnecting the plug to the drain flange from above in the sanitary element in a fixed open position.

[0079] One effect of the method may be that the drain valve may be implemented in existing or new plumbing installations by replacing an existing drain valve. This may be advantageous in regard to that the remaining plumbing installation may be unaltered.

[0080] A further effect is that the drain valve due to its design may be mountable even where the physical space is limited. The physical space just below the sanitary element where the fastening unit of the drain valve is to be located is often very limited due to cumbersome and cramped plumbing installations.

[0081] A further object of the invention may be achieved by a disinfection unit for use in a drain valve.

[0082] The effects and advantages achieved by this use are in line with the previously described effects and advantages achieved by the embodiments of the drain valve and the method for disinfecting a drain valve using the drain valve.

[0083] In one aspect the objective of the invention may be achieved with a disinfection unit for use in a drain comprising a first pipe connection arranged with an inlet, and a second pipe connection arranged with an outlet, wherein the disinfection unit comprises a housing arranged between the first and second pipe connection. The housing comprises a chamber having a larger extension in radial direction than the pipe connections and the chamber comprises an annular area. In the annular area a UV source able to emit UV light is arranged thereby leaving an open central area inside the annular area in order for liquid to flow through the disinfection unit from inlet to outlet. The disinfection unit is suitable for use in a drain provided with a plug in one end, which hinders the UV light to be visible from outside the disinfection unit.

[0084] One effect of this embodiment may be that UV light is emitted into the chamber comprised in the housing and especially in the open central area, and thus the interior surface of the chamber in the disinfection unit is illuminated with UV light thereby achieving disinfecting the chamber pipe by eliminating germs on the interior surface. The emitted UV light may spread into the first and second pipe connections and further illuminate their interior surfaces. Furthermore, the emitted UV light may spread into the drain to illuminate the drains interior surface, thereby further achieving disinfecting these parts.

[0085] In one aspect the walls of the chamber may be arranged to have inclinations to achieve proper drainage of the disinfection unit.

[0086] In one aspect the housing may be leakage proof.

[0087] In one aspect the disinfection unit may be mounted directly under any washbasin, sink, kitchen sink, bathtub or place where water flows directly into a drain.

[0088] By applying the UV illumination and elimination of germs on the interior surface of at least the chamber, a device is achieved which carefully and thoroughly ensures that the drains are clean and free from bacteria.

[0089] A further effect of the embodiment may be that the type of mounting elements and the size (diameter, wall thickness, length) of the first and second connection pipes may be customized to any given standard and size thereby achieving that the disinfection unit may fit to existing drain systems and standard parts used in plumbing installations. This has the further advantage that the disinfection unit may be mounted in direct connection with the sanitary element. This has an additional effect of reducing the drain length between the sanitary element and the disinfection unit, thereby achieving to minimize the area where fouling or sediment may deposit above the disinfection unit.

[0090] In one aspect the UV source may be operated in a continuous mode. In a continuous mode the drain is continuously exposed to UV light and thus both when water flows in the drain and the empty drain is exposed. This may be advantageous in regard to reducing the risk of germs from lower parts of the drain spreads past the disinfection unit and into the sanitary element - like establishing a UV fence or trap. Due to the low effect required for the UV expose the continuous mode may be sufficient cost effective. Furthermore, the UV source does not require regular turn on/off events, which, depending on the source, may be time- and energy consuming.

[0091] In one aspect the UV source may be operated in a time- or event controlled mode. The UV source may be activated only when the drain is empty, deactivated after a given time interval after the last water flow was registered, activated in and with fixed time intervals, a combination of these, or other relevant time- or event controlled operation modes. This may be advantageous in regard to reducing the on time of the source resulting in an increased lifetime. The trade-off between the on time and the on/off events should be considered in regard to the lifetime of the UV source and the use - both frequency and purpose - of the sanitary element.

[0092] In one aspect the lamp may be covered by a layer of material suitable to be used in drains and with properties allowing the UV light to be emitted through this material.

[0093] This may include rubber or polymer materials such as fluoropolymer but by no means limited to these. The layer may have a thickness depending on the choice of material for proper transmittance of the UV light. The effect of this cover layer may be to protect the lamp/tube, which often comprises a glass tube. This may be advantageous in regard to achieving increased durability of the UV tube/lamp and to avoid glass splinters to enter the drain.

[0094] In aspect the housing, the first pipe connection and the second pipe connection are made of material, which is opaque to UV light.

[0095] One effect of the embodiment is that that emitted UV light from the UV source may only be contained inside the disinfection unit only spreading out through the inlet and outlet depending on the intensity of the light, thereby achieving that the UV light may be confined to expose only a limited area in the disinfection unit and possibly the drain. UV light may have damaging effect on humans and thus the exposure to UV light should be avoided. This may be achieved by this embodiment.

[0096] In one aspect the housing may be comprised of multiple parts arranged to form the housing.

[0097] One effect of this embodiment may be that the housing may be dismantled to repair and maintain the unit.

[0098] The parts constituting the housing may include appropriate gaskets to achieve a leakage proof unit.

[0099] The size and shape of the housing and the UV source may be arranged to fit a given purpose.

[0100] In one aspect the emitted UV light has a wavelength in the range of 100 nm to 400 nm, preferable in the range 200 nm to 280 nm, even more preferably in the range 240 nm to 260 nm.

[0101] The effects and advantages achieved by this embodiment may be in line with the previously described effects and advantages achieved by the embodiments of the drain valve and the method for disinfecting a drain valve using the drain valve.

[0102] In one aspect the housing comprises a power connection.

[0103] The effects and advantages achieved by this embodiment may be in line with the previously described effects and advantages achieved by the embodiments of the drain valve and the method for disinfecting a drain valve using the drain valve.

[0104] In one aspect, a further object of the invention may be achieved by a method for disinfecting a drain comprising the act of illuminating a central area with UV light.

[0105] One effect of the method may be the germs on the interior surface of at least the chamber of the disinfection are eliminated thereby achieving that the spreading of germs from the drain is reduced.

[0106] In one aspect, yet a further object of the invention may be achieved by a method for disinfecting a drain using the disinfection unit.

[0107] The effects and advantages achieved by this method are in line with the previously described effects and advantages achieved by the embodiments of the disinfection unit.

[0108] An object of the invention may be achieved by a method of mounting a plumbing installation with the disinfection unit providing a plumbing installation and retrofitting the existing plumbing installation with the disinfection unit.

[0109] One effect of the method may be that the disinfection unit may be implemented in existing or new plumbing installations by replacing a part of the drain with the disinfection unit. This may be advantageous in regard to that the remaining plumbing installation may be unaltered. An additional effect is that the disinfection unit may be mounted in a suitable place in the drainage system where the physical space is available, however as close to the sanitary element as possible for optimal use of the unit.

[0110] This is advantageous in regard to the often cumbersome and cramped plumbing installations.

[0111] In yet a further aspect, the invention involves use of the drain valve for disinfection of the valve. The use involves using the disinfection unit in a plumbing installation.

[0112] The effects and advantages achieved by this use are in line with the previously described effects and advantages achieved by the embodiments of the disinfection unit and the method for disinfecting a drain using the disinfection unit.

[0113] The drain valve has been tested by the Danish Technological Institute, Bioengineering and Environmental Technology.

[0114] The test included:

- Quantitative analysis of bacteria in biofilm (depth: 6 cm from drain) in test sink and control sink before and after installation of a new UV bottom valve (test sink), i.e. disinfection (control sink). The number of bacteria was quantified as the total viable count at 22 °C.
- Quantitative analysis of bacteria in biofilm (depth: 6 cm from drain) in test and control sink after 11 and 42 days of identical use of both sinks. The number of bacteria was quantified as the total viable count at 22 °C.
- Measurement of external temperature of the UV bottom valve.

[0115] The results of the test are as follows:

Biofilm formation

[0116] Samples that were taken before installation of UV bottom valve (test sink) and cleaning (control sink) represents normal sink conditions after a long-term use. The analysis confirms that the sink drain pipe is covered with biofilm with numerous (>1010 CFU/0.5 cm2) bacteria.

[0117] Samples from day 0, taken directly after installation of UV bottom valve in the test sink and disinfection of the control sink, exhibited a comparable number of bacteria (approx. 100 CFU/0.5 cm2) in these two drain pipes.

[0118] After 11 days of normal use of both sinks, on average 3200 CFU/0.5 cm2 were detected in the control sink, while it was not possible to observe any growth on the sampling plates from the test sink.

[0119] After 42-day normal use of both sinks, on average >40,000 CFU/0.5 cm2 were detected in the control sink, while <100 CFU/0.5 cm2 were detected in test sink drain.

External sink temperature

[0120] The external temperature of the UV bottom valve was measured on day 5 during the test period and was 38.1 °C.

Description of the Drawing

[0121]

Fig. 1 illustrates one embodiment of the fastening unit in top view.
Fig. 2 illustrates one embodiment of the fastening unit in side view.
Fig. 3 illustrates one embodiment of the drain valve in a side view.
Fig. 4 illustrates a zoom of two examples of treaded connections between the drain flange and the fastening unit.
Fig. 5 illustrates one embodiment of the fastening unit comprising multiple parts.
Fig. 6 illustrates one embodiment of the housing and the chamber from a top view.
Fig. 7 illustrates one embodiment of the disinfection unit in a perspective view.
Fig. 8 illustrates a method for mounting a sanitary element with the drain valve.

Detailed Description of the Invention

No	Item
1	Drain valve
2	Plug
3	Drain flange
4	Fastening unit
5	Drain valve inner surface
10	Disinfection unit
12	UV source
12a	First UV source
12b	Second UV source
13	UV light
14	Housing
15	Chamber
17	First pipe connection
18	Second pipe connection

(continued)

No	Item
19	Annular area
20	Central area
22	Exterior surface
26	Inlet
28	Outlet
30	Mounting element
40	Drain
50	Plumbing installation
52	Drainage system
60	Liquid
70	Power connection
72	Plug
74	Socket
76	Cord/lead/cable
80	UV-translucent tube
90	Channel
92	Channel inner surface
110	Method for disinfecting
120	Method for mounting
130	providing
140	Placing
150	Screwing
160	Interconnecting
210	Stop recess for UV-translucent tube
212	Holder for UV source
214	Stop pin
216	Tension spring
220	outer periphery
230	cassette
240	inner wall
260	internal thread
262	Stop recess for drain flange
270	drain valve outer surface
280	plug cleanable surface
290	Gasket / O-ring
300	Sanitary element
304	evacuation hole
310	open position

(continued)

No	Item
400	Use

[0122] One embodiment of the fastening unit 4 configured as a disinfection unit 10 is illustrated in figure 1 as seen from a top view. The fastening unit 4 comprises first pipe connection 17 and second pipe connection 18 and a housing 14 having a larger extension in radial direction than the pipe connections 17,18. The fastening unit further comprises a UV-translucent tube 80 located between the pipe connections 17,18. The housing 14 comprises a chamber 15 with an annular area 19 wherein a UV source 12 is arranged. The UV-translucent tube 80 constitutes the inner wall 240 of the chamber 15 in whole or partly. The chamber 15 encircles a central are 20, which forms a channel 90 with a channel inner surface 92 for liquid to flow through. The channel 90 and the channel inner surface 92 are formed by the first pipe connection 17, the UV-translucent tube 80 and the second pipe connection 18.

[0123] The housing 14 comprises a power connection 70 located outside the chamber 15. The power connection 70 in this embodiment is illustrated as a socket 74 or a plug 72 connector but may be a battery, a cable or other types of power connections. The power connection 70 may be encapsulated and/or sealed for ensuring a secure and stable connection.

[0124] Figure 2 illustrates one embodiment of the fastening unit 4 configured as a disinfection unit 10. The illustrated fastening unit 4 is shown in a side view. The unit 4,10 comprises a first pipe connection 17 and a second pipe connection 18 and a housing 14 having a larger extension in radial direction than the pipe connections 17,18.

[0125] The first pipe connection 17 is arranged with an inlet 26, and the second pipe connection 18 arranged is arranged with an outlet 28.

[0126] The housing 14 comprises a UV source 12 here illustrated with a torus shape. The housing 14 comprises a chamber 15 with an annular area 19 in which the UV source 12 is comprised. The chamber 15 and the UV source 12 is arranged such that, an open central area 20 inside the annular area 19 is left open, in order for liquid 60 to flow through the fastening unit 4 configured as a disinfection unit 10 from the inlet 26 to the outlet 28.

[0127] The unit 4,10 has an interior surface, being the channel surface 92 and an exterior surface forming part of the drain valve outer surface 270, here illustrated in connection with the first pipe connection 17. The channel surface 92 forms part of or is connected to a drainage system 52 when mounted in a plumbing installation 50 (50 and 52 is not shown).

[0128] Hence, the chamber 15 encircles a central area 20, which forms a channel 90 with a channel inner surface 92 for liquid 60 to flow through from inlet 26 to outlet 28.

The channel 90 and the channel inner surface 92 are formed by the first pipe connection 17, the UV-translucent tube 80 and the second pipe connection 18.

[0129] The housing comprises a power connection 70 located outside the chamber 15. The power connection 70 may be a socket 74 or a plug 72 connector, a cable 76 or other types of power connections.

[0130] Figure 3 illustrates one embodiment of a drain valve 1 comprising two UV sources 12a,12b in the chamber 15. The drain valve 1 comprises a plug 2, a drain flange 3 and a fastening unit 4. The drain valve 1 has an inner surface 5 and an outer surface 270. The drain valve 1 is illustrated as separate parts, arranged to be mounted in a sanitary element 300, where the drain flange 3 is arranged through the evacuation hole 304 in the sanitary element 300.

[0131] The plug 2 is illustrated to be interconnected with the drain flange 3 from inside the sanitary element 300. The plug 2 has a plug cleanable surface 280. The part of the plug cleanable surface 280 facing the fastening unit 4 also forms part of the drain valve inner surface 5. The plug is adapted to be interconnected with the drain flange 3 in a fixed open position 310.

[0132] A fixed open position 310 of the plug 2 achieves for a drain valve 1 suitable for use in a sanitary element 300 without overflow.

[0133] The fastening unit 4 is adapted to be screwed onto the drain flange 3 below the sanitary element 300 to fasten the drain flange 3 to the sanitary element.

[0134] The fastening unit 4 comprises an internal thread 260 at the inlet side adapted to interconnect with the drain flange 3. The fastening unit 4 further comprises a UV-translucent tube 80 which forms part of the channel 90 with an inner surface 92, a channel adapted for leading the wastewater away from the sanitary element 300.

[0135] The UV-translucent tube 80 is arranged such that it acts as an inner wall 240 of the chamber 15 with an annular area 19.

[0136] The two UV sources are arranged in the chamber 15 together with a cassette 230. The illustrated cassette 230 comprises a vertical wall arranged between the horizontal part of the chamber and the UV-sources and running along the outer periphery of both UV sources. The cassette further comprises a horizontal part arrange in between the two UV sources.

[0137] The first UV source 12a is placed closest to the sanitary element 300 and thereby closest to the inlet of the fastening unit 4. The second UV source 12b is illustrated to be placed immediately below the first UV source 12a only separated by parts of the cassette 230. The UV sources may emit UV-light 13 with different wavelengths to cover a larger spectrum. Alternatively, two UV sources 12 with the same wavelength range may be used to enhance the level of emitted UV light or to ensure that even if one stops working the other one may continue to work.

[0138] The annular area 19 encircles a central area 20 with an outer periphery 220. The outer periphery 220 is defined by the UV-translucent tube 80. The central area 20 is continuously exposed to the emitted UV light 13.

[0139] The fastening unit 4 further comprises a power connection 70 on the drain valve outer surface 270, here arrange in connection with the housing and facing away from the sanitary element 300. This position of the plug may reduce any sediment from the surrounding to enter the power connection. The power connection is illustrated as a plug 72 but may be a connected battery packet, a socket, a cable or similar suitable power connections.

[0140] The highlighted area "A" comprises the threaded connection of the drain flange 3 and the fastening unit 4. This is further illustrated in figures 4a and 4b.

[0141] Fig. 4 illustrates a zoom of the area "A" highlighted in figure 3 illustrating the threaded connection between the drain flange 3 and the fastening unit 4. Two different embodiments are illustrated.

[0142] The fastening unit 4 has an inner threading 260 adopted to be screwed onto an outer threading of the drain flange 3. In the embodiment in figure 4a the fastening unit 4 comprises a stop recess 262 for the drain flange 3. This recess may be a security measure for a proper tightening of the drain valve if it is customized to a specific sanitary element or a standard within sanitary elements. This embodiment may further comprise a gasket arrange on the stop recess (not illustrated). This embodiment may provide for an even the sided channel. However, if the thickness of the sanitary unit is different to that thickness for which the drain valve is fitted, either in case of a thinner element the drain valve may not be sufficiently tightened to the sanitary element with the result of a non-leakage-proof installation or in case of a thicker element the drain valve may be sufficiently tight but with the result of a cavity being formed in the channel.

[0143] The embodiment of figure 4b is without stop recesses on the fastening unit 4. This embodiment is suitable for drain valves which should be mountable regardless of the thickness of the sanitary element or variations in the thickness. Omitting the stop recess may ensure a leakage-proof installation for sanitary elements with variable thicknesses within the single sanitary element and for different sanitary elements which in general may differ in thickness.

[0144] Figure 5 illustrates one embodiment of the fastening unit 4 wherein the housing 14 comprises multiple parts such that the unit 4 can be disassembled for maintenance and service. Only the elements forming the outer surface of the fastening unit are illustrated.

[0145] The fastening element comprises one part with the first pipe connection 17 and the inlet 26, another part with the second pipe connection 18 and the outlet 28. These two parts also forms part of the channel 90. The two parts may comprise gaskets 290 appropriately placed to achieve a leakage proof unit.

[0146] In between the two parts a gasket 290 is arranged to ensure a seal construction when assembled. It should be sufficiently seal to prevent any UV-light escaping the fastening unit from the jointing and to prevent dust and moisture to enter through the jointing.

[0147] Both pipe connections 17,18 comprises a stop recess for the UV-translucent tube 80 (not shown) which is a part of the fastening unit 4. The stop recesses 210 are arrange such that the UV-translucent tube is placed in between these thereby holding the tube firmly in the assembled fastening unit 4. Furthermore, the stop recess in the first pipe connection 17 is placed below the internal threading 260.

[0148] Fig. 6 illustrates one embodiment of a cassette 230. In figure 6a the cassette is illustrated from a top view and in figure 6b in a side view. The cassette comprises an open central area 20 for the UV-translucent tube 80 and the channel 90. The illustrated embodiment of the cassette holds two UV sources 12 comprising a UV tube in a torus shape.

[0149] The cassette further comprises three holders 212 for the UV source 12, three stop pins 214 each encircled by a tension spring 216. These means are provided for easy assembly of the fastening unit 4 both in production but also in regard to maintenance and/or service. In this embodiment three holders 212 for the UV source 12, three stop pins 214 and three tension springs 216 are used. However, a higher or lower number may be used and the number of holders 212 may differ from the number of stop pins 214 and/or tension springs 216.

[0150] The stop pins 214 and tension springs 216 may be provided to adjust the cassette 230.

[0151] The stop pins and tension springs may be provided to avoid overtightening the fastening unit during assembly in regard to avoid exerting excess tension on the UV-translucent tube.

[0152] In the illustrated embodiment the cassette is made to hold a first and a second UV source 12a,12b. In case of a fastening unit 4 which only comprises a single UV source 12 the cassette may be designed accordingly.

[0153] Figure 7 illustrates one embodiment of the disinfection unit 10. The illustrated disinfection unit 10 is shown in a perspective view. The first pipe connection17 comprises an inlet 26 and may comprise a mounting element 30. In the illustrated embodiment the mounting element 30 is a recess forming a flange or collar, which may use to mount the device to an existing drain 40 in a plumbing installation 50 (not shown). The second pipe connection18 comprises an outlet 28 and may comprise amounting element 30. In the illustrated embodiment the mounting element 30 is a threading on the exterior surface 22, which may use to mount the disinfection unit 10 to a drain 40 in an existing piping of a plumbing installation 50 (not shown). The housing comprises a power connection 70, here illustrated as a plug 72 connector.

[0154] Figure 7 further illustrated an embodiment of the disinfection unit 10 where the unit 10 is used in a drain 40 provided with a plug 4 in one end. The plug 4 may be used to hinder the UV light emitted by the UV lamp inside the drainage system to be visible from the outside, when using a sanitary element 300 connected to the drainage system 52 - only the drain(s) 40 and plug 4 are illustrated in the figure.

[0155] Figure 8a illustrates a method for mounting 120 a sanitary element 300 with a drain valve. The method comprises an act of providing 130 a sanitary element 300. The method further includes that, the drain flange 3 is placed 140 through an evacuation hole 304 in the sanitary element 300. Thus, the drain flange becomes a through-going element in the evacuation hole. The method comprises a further act of screwing 150 the fastening unit 4 of the drain valve 1 onto the drain flange 3 below the sanitary element 300 to fasten the drain flange 3 to the sanitary element 300. Also included in the method is an act of interconnecting 160 the plug 2 to the drain flange 3 from above in the sanitary element 300 in a fixed open position 310.

[0156] Figure 8b illustrates a method for disinfecting 110 a drain valve inner surface using a drain valve 1.

[0157] Figure 8c illustrates the use 400 of a disinfection unit 10 in a drain valve.

Claims

1. Drain valve (1) configured for sanitary elements (300) without overflow, said drain valve (1) comprising a plug (2), a drain flange (3), a fastening unit (4) and a drain valve inner surface (5) and a drain valve outer surface (270), said drain flange (3) is adapted for being arranged through an evacuation hole (304) in a sanitary element (300), wherein said fastening unit (4) is configured as a disinfection unit (10), said fastening unit (4) comprises:

    - a first pipe connection (17) configured with an inlet (26), and an internal thread (260);
    - a second pipe connection (18) arranged with an outlet (28);
    - a UV-translucent tube (80) arranged in between the first (17) and second (18) pipe connection, so that the pipe connections (17, 18) and the UV-translucent tube (80) are located in extension of each other to form a channel (90) with an inner surface (92) in order for liquid (60) to flow through the fastening unit (4) from inlet (26) to outlet (28), and
    - a housing (14) configured with an inner wall (240), wherein the inner wall (240) comprises the UV-translucent tube (80), which housing (14) comprises a chamber (15) having a larger extension in radial direction than the pipe connections (17,18) and an annular area (19) in which annular area (19) a continuous mode UV source (12) is arranged, wherein a central area (20) with an outer periphery (220) defined by the UV-translucent tube (80) is continuously exposed to UV light, and where the first pipe connection (17) is adapted to be screwed onto the drain flange (3) below the sanitary element (300) to fasten the drain flange (3) to the sanitary el-

ement (300) and where the drain flange (3) and the plug (2) are adapted to be interconnected in a fixed open position (310).

2. Drain valve (1) according to claim 1, wherein the fastening unit (4) is configured to spread the UV light (13) beyond the fastening unit (4) out through the inlet (26) and outlet (27).

3. Drain valve (1) according to any one of the preceding claims, wherein (10) the parts forming the drain valve outer surface (270) are made of one or more materials, which are opaque to UV light (13).

4. Drain valve (1) according to any one of the preceding claims wherein the UV source (12) emits UV light (13) with a wavelength in the range of 100 nm to 400 nm, preferable in the range 200 nm to 280 nm, even more preferably in the range 240 nm to 260 nm.

5. Drain valve (1) according to any one of the preceding claims wherein the housing (14) comprises multiple parts such that the fastening unit (4) can be disassembled for maintenance and service.

6. Drain valve (1) according to any one of the preceding claims, which further comprises a cassette (230) made of a high-reflective material for UV light, which cassette (130) is mountable in the annular area (19) inside the chamber (15) and is configured for partly surrounding a UV source (12), such that the emitted UV light (13) is directed towards the UV-translucent tube (80).

7. Drain valve (1) according to claim 6, which comprises multiple UV sources (12) arranged on top of each other in a direction along the channel (90), such that each UV source surrounds or partly surrounds the UV-translucent tube (80), where the UV sources (12) are arranged in an descending order according to the emitted wavelengths with the UV source (12) emitting UV light with the shortest wavelength placed closest to the outlet (28), and where each UV source (12) is separated from each other by a part of a cassette (230), such that the UV sources (12) are not directly exposed to UV light (13) emitted from an adjacent UV source (12).

8. Drain valve (1) according to claim 7 comprising two UV sources (12), where a first UV source (12a) has a wavelength in the range of 200 nm to 280 nm, preferably in the range 240 nm to 260 nm and a second UV source (12b) has a wavelength in the range of 140 nm to 200 nm, preferably in the range 170 nm to 190 nm.

9. Drain valve (1) according to any one of the preceding claims wherein the parts forming the inner surface of the channel (92) comprise a flush inner surface.

10. Drain valve (1) according to any one of the preceding claims wherein the housing (14) comprises a power connection (70) accessible from the outer surface (270).

11. Drain valve (1) according to any one of the preceding claims, wherein the plug (2) is configured with a plug cleanable surface (280) without cavities, said plug cleanable surface (280) is a part of the plug's (2) outer surface being placed inside the drain valve (1) and/or facing the disinfection unit (10), such that the plug cleanable surface (280) is illuminated by the emitted UV light (13).

12. A method for disinfecting (110) a drain valve inner surface (5) using a drain valve (1) according to any one of the preceding claims 1 to 11.

13. A method for mounting (120) a sanitary element (300) with a drain valve (1) according to any one of the claims 1 to 11 comprising acts of:

- providing (130) a sanitary element (300);
- placing (140) the drain flange (3) of the drain valve (1) through an evacuation hole (304) in the sanitary element (300);
- screwing (150) the fastening unit (4) of the drain valve (1) onto the drain flange (3) below the sanitary element (300) to fasten the drain flange (3) to the sanitary element (300), and
- interconnecting (160) the plug (2) to the drain flange (3) from above in the sanitary element (300) in a fixed open position (310).

Patentansprüche

1. Ablassventil (1), das für Sanitärelemente (300) ohne Überlauf konfiguriert ist, wobei das Ablassventil (1) einen Stopfen (2), einen Ablassflansch (3), eine Befestigungseinheit (4) und eine Ablassventilinnenoberfläche (5) und eine Ablassventilaußenoberfläche (270) umfasst, wobei der Ablassflansch (3) angepasst ist, um durch ein Entleerungsloch (304) in einem Sanitärelement (300) angeordnet zu werden, wobei die Befestigungseinheit (4) als eine Desinfektionseinheit (10) konfiguriert ist, wobei die Befestigungseinheit (4) umfasst:

- einen ersten Rohranschluss (17), der mit einem Einlass (26) und einem Innengewinde (260) konfiguriert ist;
- einen zweiten Rohranschluss (18), der mit einem Auslass (28) angeordnet ist;
- ein UV-durchlässiger Schlauch (80), der zwischen dem ersten (17) und dem zweiten (18)

Rohranschluss angeordnet ist, sodass sich die Rohranschlüsse (17, 18) und der UVdurchlässige Schlauch (80) in Ausdehnung zueinander befinden, um einen Kanal (90) mit einer Innenoberfläche (92) auszubilden, damit Flüssigkeit (60) durch die Befestigungseinheit (4) von dem Einlass (26) zu dem Auslass (28) fließt, und
- ein mit einer Innenwand (240) konfiguriertes Gehäuse (14), wobei die Innenwand (240) den UV-durchlässigen Schlauch (80) umfasst, wobei das Gehäuse (14) eine Kammer (15) mit einer größeren Ausdehnung in radialer Richtung als die Rohranschlüsse (17, 18) und eine ringförmige Fläche (19) umfasst, wobei in dieser ringförmigen Fläche (19) eine UV-Quelle (12) mit kontinuierlichem Modus angeordnet ist, wobei eine zentrale Fläche (20) mit einem äußeren Umfang (220), der durch den UV-durchlässigen Schlauch (80) definiert wird, kontinuierlich UV-Licht ausgesetzt wird, und wobei der erste Rohranschluss (17) angepasst ist, um auf den Abflussflansch (3) unterhalb des Sanitärelements (300) geschraubt zu werden, um den Abflussflansch (3) an dem Sanitärelement (300) zu befestigen, und wobei der Abflussflansch (3) und der Stopfen (2) angepasst sind, in einer fixierten offenen Position (310) miteinander verbunden zu werden.

2. Ablassventil (1) nach Anspruch 1, wobei die Befestigungseinheit (4) dazu konfiguriert ist, das UV-Licht (13) über die Befestigungseinheit (4) hinaus durch den Einlass (26) und den Auslass (27) auszustrahlen.

3. Ablassventil (1) nach einem der vorhergehenden Ansprüche, wobei (10) die Teile, die die Ablassventilaußenoberfläche (270) ausbilden, aus einem oder mehreren Materialien hergestellt sind, die für UV-Licht (13) undurchlässig sind.

4. Ablassventil (1) nach einem der vorhergehenden Ansprüche, wobei die UV-Quelle (12) UV-Licht (13) mit einer Wellenlänge in dem Bereich von 100 nm bis 400 nm, vorzugsweise in dem Bereich von 200 nm bis 280 nm, stärker bevorzugt im dem Bereich von 240 nm bis 260 nm, emittiert.

5. Ablassventil (1) nach einem der vorhergehenden Ansprüche, wobei das Gehäuse (14) mehrere Teile umfasst, sodass die Befestigungseinheit (4) zu Wartungs- und Servicezwecken demontiert werden kann.

6. Ablassventil (1) nach einem der vorhergehenden Ansprüche, das ferner eine Kassette (230) umfasst, die aus einem hochreflektierenden Material für UV-Licht hergestellt ist, wobei die Kassette (130) in der ringförmigen Fläche (19) innerhalb der Kammer (15) montierbar ist und dazu konfiguriert ist, eine UV-Quelle (12) teilweise zu umgeben, sodass das emittierte UV-Licht (13) in Richtung des UV-durchlässigen Schlauchs (80) gelenkt wird.

7. Ablassventil (1) nach Anspruch 6, das mehrere UV-Quellen (12) umfasst, die in einer Richtung entlang des Kanals (90) übereinander angeordnet sind, sodass jede UV-Quelle den UV-durchlässigen Schlauch (80) umgibt oder teilweise umgibt, wobei die UV-Quellen (12) in einer absteigenden Reihenfolge gemäß den emittierten Wellenlängen angeordnet sind, wobei die UV-Quelle (12), die UV-Licht mit der kürzesten Wellenlänge emittiert, am nächsten zu dem Auslass (28) platziert ist, und wobei jede UV-Quelle (12) durch einen Teil einer Kassette (230) voneinander getrennt ist, sodass die UV-Quellen (12) nicht direkt dem von einer benachbarten UV-Quelle (12) emittierten UV-Licht (13) ausgesetzt sind.

8. Ablassventil (1) nach Anspruch 7, umfassend zwei UV-Quellen (12), wobei eine erste UV-Quelle (12a) eine Wellenlänge in dem Bereich von 200 nm bis 280 nm, vorzugsweise in dem Bereich von 240 nm bis 260 nm, aufweist und eine zweite UV-Quelle (12b) eine Wellenlänge in dem Bereich von 140 nm bis 200 nm, vorzugsweise in dem Bereich von 170 nm bis 190 nm, aufweist.

9. Ablassventil (1) nach einem der vorhergehenden Ansprüche, wobei die Teile, die die Innenoberfläche des Kanals (92) ausbilden, eine bündige Innenoberfläche umfassen.

10. Ablassventil (1) nach einem der vorhergehenden Ansprüche, wobei das Gehäuse (14) eine Leistungsverbindung (70) umfasst, die von der Außenoberfläche (270) aus zugänglich ist.

11. Ablassventil (1) nach einem der vorhergehenden Ansprüche, wobei der Stopfen (2) mit einer hohlraumfreien, reinigbaren Oberfläche (280) konfiguriert ist, wobei die reinigbare Oberfläche (280) des Stopfens ein Teil der Außenoberfläche des Stopfens (2) ist, der im Inneren des Ablassventils (1) platziert und/oder der Desinfektionseinheit (10) zugewandt ist, sodass die reinigbare Oberfläche (280) des Stopfens durch das emittierte UV-Licht (13) beleuchtet wird.

12. Verfahren zum Desinfizieren (110) einer Ablassventilinnenoberfläche (5) unter Verwendung eines Ablassventils (1) nach einem der vorhergehenden Ansprüche 1 bis 11.

13. Verfahren zum Montieren (120) eines Sanitärele-

ments (300) mit einem Ablassventil (1) nach einem der Ansprüche 1 bis 11, umfassend die Aktionen von:

- Bereitstellen (130) eines Sanitärelementes (300);
- Platzieren (140) des Ablassflansches (3) des Ablassventils (1) durch ein Entleerungsloch (304) in dem Sanitärelement (300);
- Aufschrauben (150) der Befestigungseinheit (4) des Ablassventils (1) auf den Ablassflansch (3) unterhalb des Sanitärelements (300), um den Ablassflansch (3) an dem Sanitärelement (300) zu befestigen, und
- Verbinden (160) des Stopfens (2) mit dem Ablassflansch (3) von oben in dem Sanitärelement (300) in einer fixierten offenen Position (310).

Revendications

1. Vanne de vidange (1) configurée pour des éléments sanitaires (300) sans trop-plein, ladite vanne de vidange (1) comprenant un bouchon (2), une bride de vidange (3), une unité de fixation (4) et une surface intérieure de vanne de vidange (5) et une surface extérieure de vanne de vidange (270), ladite bride de vidange (3) est adaptée pour être agencée à travers un trou d'évacuation (304) dans un élément sanitaire (300), dans laquelle ladite unité de fixation (4) est configurée en tant qu'unité de désinfection (10), ladite unité de fixation (4) comprend :

- un premier raccord de tuyau (17) configuré avec une entrée (26) et un filetage interne (260) ;
- un deuxième raccord de tuyau (18) agencé avec une sortie (28) ;
- un tube translucide aux UV (80) agencé entre le premier (17) et le deuxième (18) raccord de tuyau, de sorte que les raccords de tuyau (17, 18) et le tube translucide aux UV (80) sont situés dans le prolongement les uns des autres pour former un canal (90) avec une surface intérieure (92) afin que le liquide (60) s'écoule à travers l'unité de fixation (4) à partir de l'entrée (26) à la sortie (28), et
- un boîtier (14) configuré avec une paroi intérieure (240), dans laquelle la paroi intérieure (240) comprend le tube translucide aux UV (80), lequel boîtier (14) comprend une chambre (15) ayant une plus grande extension dans la direction radiale que les raccords de tuyau (17, 18) et une zone annulaire (19) dans laquelle la zone annulaire (19) est agencée d'une source UV en mode continu (12), dans laquelle une zone centrale (20) avec une périphérie extérieure (220) définie par le tube translucide aux UV (80) est continuellement exposé à la lumière UV, et où le premier raccord de tuyau (17) est adapté pour être vissé sur la bride de vidange (3) sous l'élément sanitaire (300) pour fixer la bride de vidange (3) à l'élément sanitaire (300) et où la bride de vidange (3) et le bouchon (2) sont adaptés pour être interconnectés dans une position ouverte fixe (310).

2. Vanne de vidange (1) selon la revendication 1, dans laquelle l'unité de fixation (4) est configurée pour diffuser la lumière UV (13) au-delà de l'unité de fixation (4) à travers l'entrée (26) et la sortie (27).

3. Vanne de vidange (1) selon l'une quelconque des revendications précédentes, dans laquelle (10) les parties formant la surface extérieure de la vanne de vidange (270) sont réalisées en un ou plusieurs matériaux opaques à la lumière UV (13).

4. Vanne de vidange (1) selon l'une quelconque des revendications précédentes dans laquelle la source UV (12) émet de la lumière UV (13) avec une longueur d'onde dans la plage de 100 nm à 400 nm, préférablement dans la plage de 200 nm à 280 nm, encore plus préférablement dans la plage de 240 nm à 260 nm.

5. Vanne de vidange (1) selon l'une quelconque des revendications précédentes, dans laquelle le boîtier (14) comprend plusieurs parties de sorte que l'unité de fixation (4) peut être démontée pour l'entretien et le service.

6. Vanne de vidange (1) selon l'une quelconque des revendications précédentes, qui comprend en outre une cassette (230) faite d'un matériau hautement réfléchissant pour la lumière UV, laquelle cassette (130) peut être montée dans la zone annulaire (19) à l'intérieur la chambre (15) et est configurée pour entourer partiellement une source UV (12), de sorte que la lumière UV émise (13) est dirigée vers le tube translucide aux UV (80).

7. Vanne de vidange (1) selon la revendication 6, qui comprend plusieurs sources UV (12) disposées les unes au-dessus des autres dans une direction le long du canal (90), de sorte que chaque source UV entoure ou entoure partiellement le tube translucide aux UV (80), où les sources UV (12) sont disposées dans un ordre décroissant selon les longueurs d'onde émises, la source UV (12) émettant de la lumière UV avec la longueur d'onde la plus courte étant placée le plus près de la sortie (28), et où chaque source UV (12) est séparée l'une de l'autre par une partie d'une cassette (230), de sorte que les sources UV (12) ne sont pas directement exposées à la lumière UV (13) émise par une source UV adjacente (12).

8. Vanne de vidange (1) selon la revendication 7 comprenant deux sources UV (12), où une première source UV (12a) a une longueur d'onde dans la plage de 200 nm à 280 nm, préférablement dans la plage de 240 nm à 260 nm et une deuxième source UV (12b) a une longueur d'onde dans la plage de 140 nm à 200 nm, préférablement dans la plage de 170 nm à 190 nm.

9. Vanne de vidange (1) selon l'une quelconque des revendications précédentes dans laquelle les parties formant la surface intérieure du canal (92) comportent une surface intérieure affleurante.

10. Vanne de vidange (1) selon l'une quelconque des revendications précédentes dans laquelle le boîtier (14) comprend une connexion électrique (70) accessible depuis la surface extérieure (270).

11. Vanne de vidange (1) selon l'une quelconque des revendications précédentes, dans laquelle le bouchon (2) est configuré avec une surface nettoyable du bouchon (280) sans cavités, ladite surface nettoyable du bouchon (280) fait partie de la surface extérieure du bouchon (2) étant placée à l'intérieur de la vanne de vidange (1) et/ou faisant face à l'unité de désinfection (10), de sorte que la surface nettoyable du bouchon (280) est éclairée par la lumière UV émise (13).

12. Procédé de désinfection (110) d'une surface intérieure de vanne de vidange (5) utilisant une vanne de vidange (1) selon l'une quelconque des revendications précédentes 1 à 11.

13. Procédé de montage (120) d'un élément sanitaire (300) avec un vanne de vidange (1) selon l'une quelconque des revendications 1 à 11 comprenant les actes consistant à :

- fournir (130) un élément sanitaire (300) ;
- placer (140) la bride de vidange (3) de la vanne de vidange (1) à travers un trou d'évacuation (304) dans l'élément sanitaire (300) ;
- visser (150) l'unité de fixation (4) de la vanne de vidange (1) sur la bride de vidange (3) sous l'élément sanitaire (300) pour fixer la bride de vidange (3) à l'élément sanitaire (300), et
- interconnecter (160) le bouchon (2) à la bride de vidange (3) par le dessus dans l'élément sanitaire (300) dans une position ouverte fixe (310).

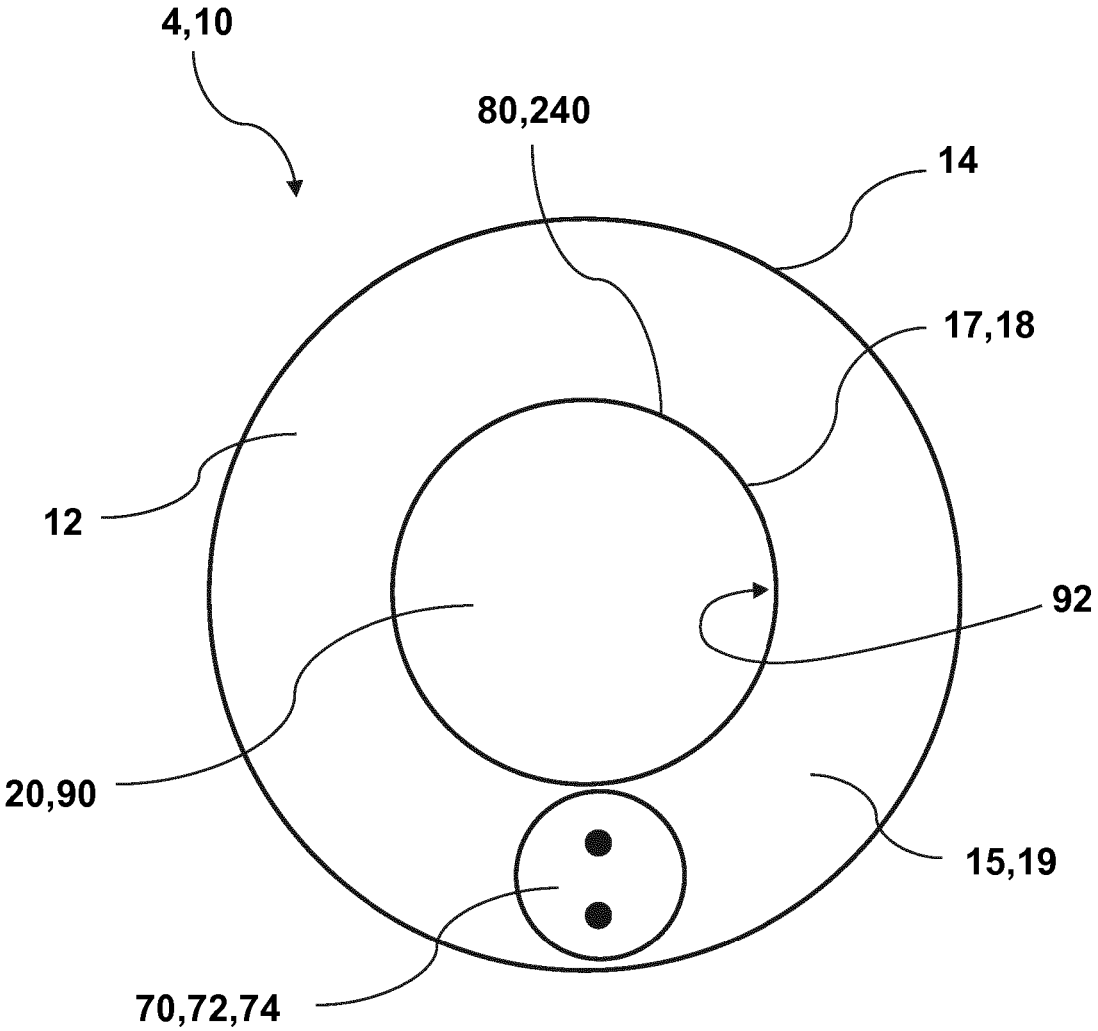

Fig. 1

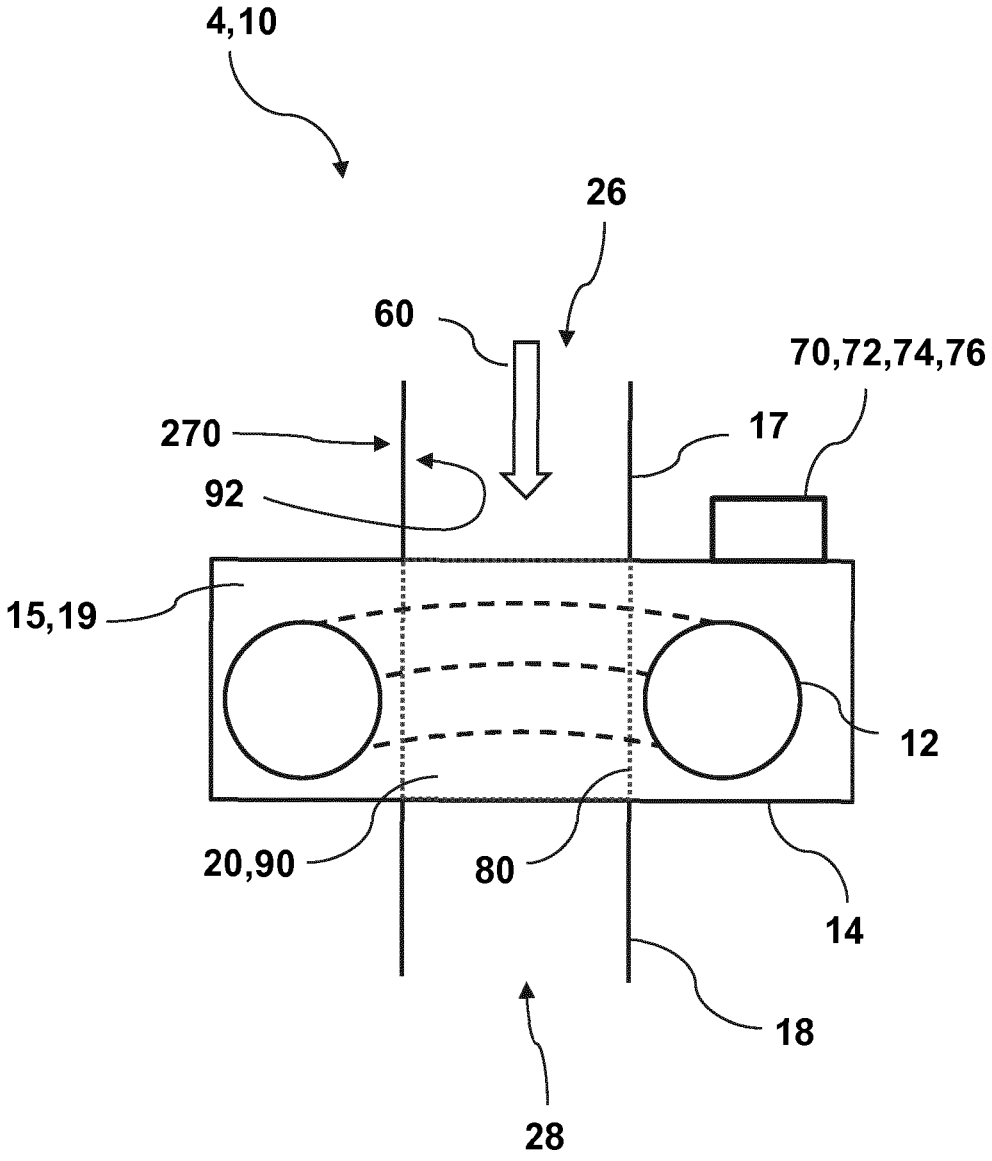

Fig. 2

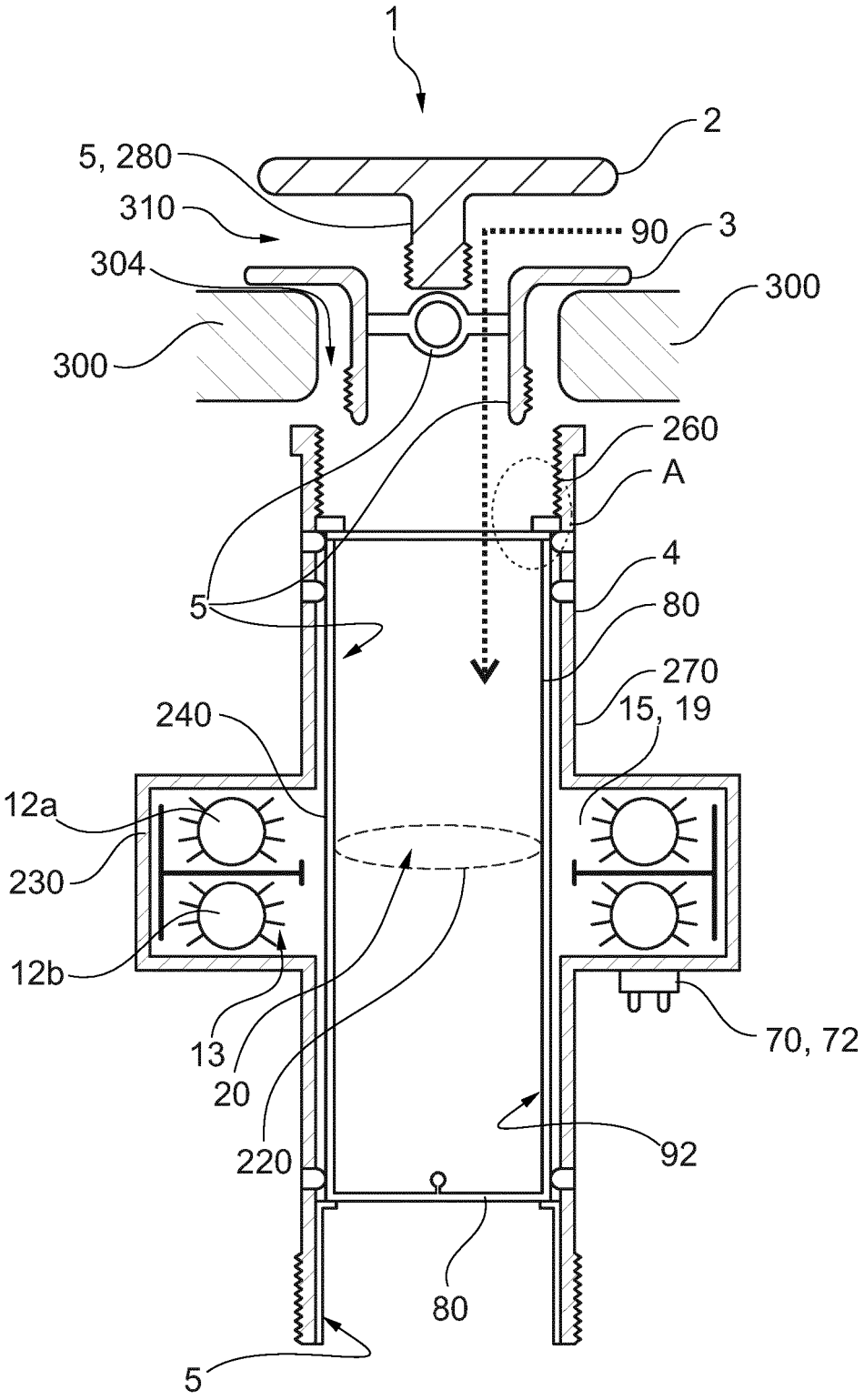
1
2
5, 280
310
90
3
304
300
300
260
A
4
5
80
270
15, 19
240
12a
230
12b
13
20
220
92
70, 72
80
5

Fig. 3

Fig. 4a

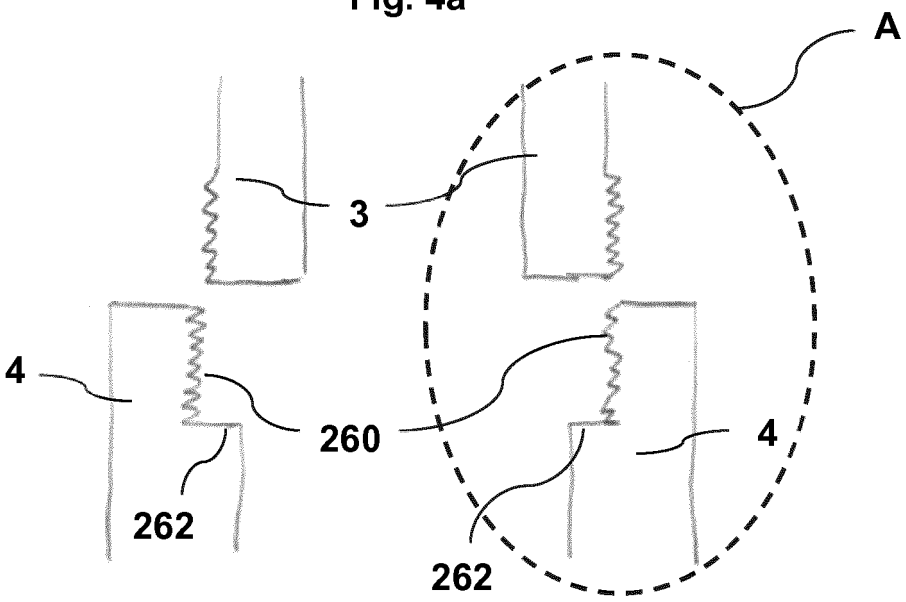

Fig. 4b

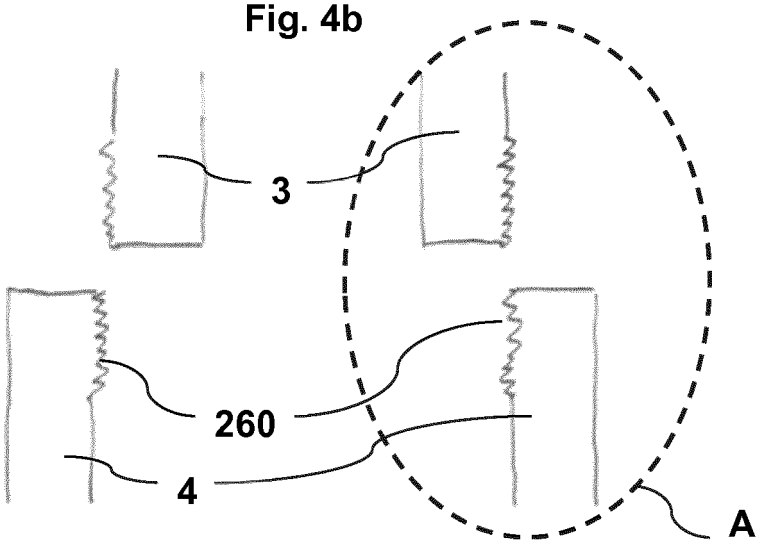

Fig. 4

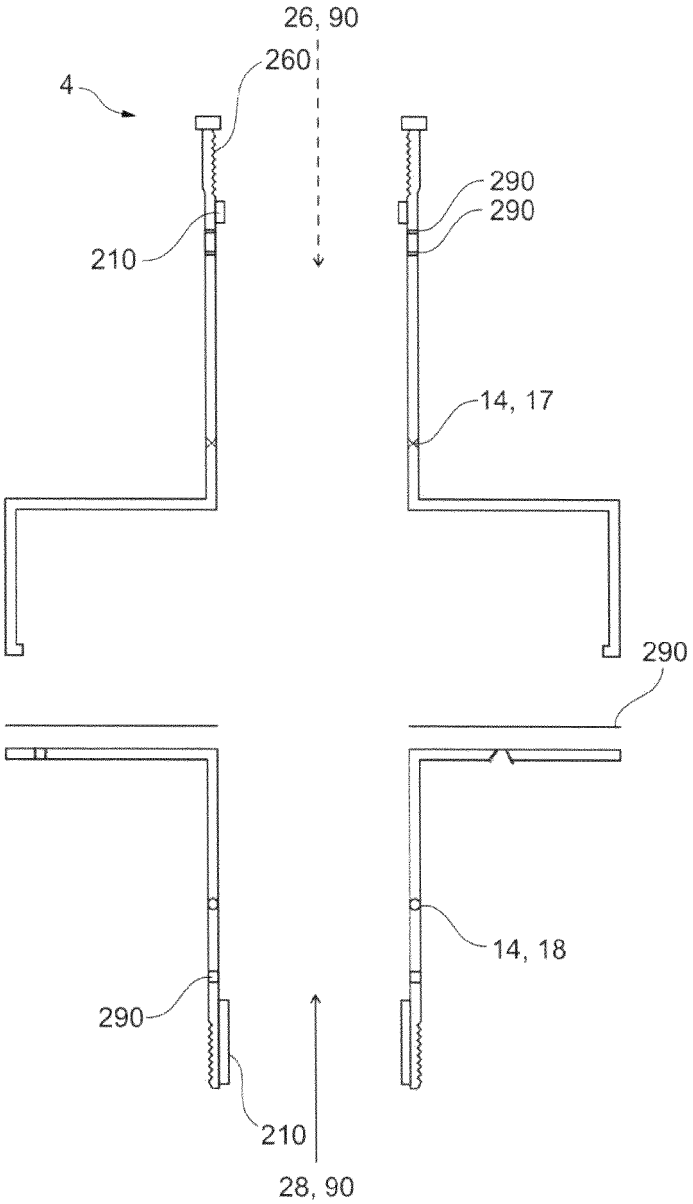

Fig. 5

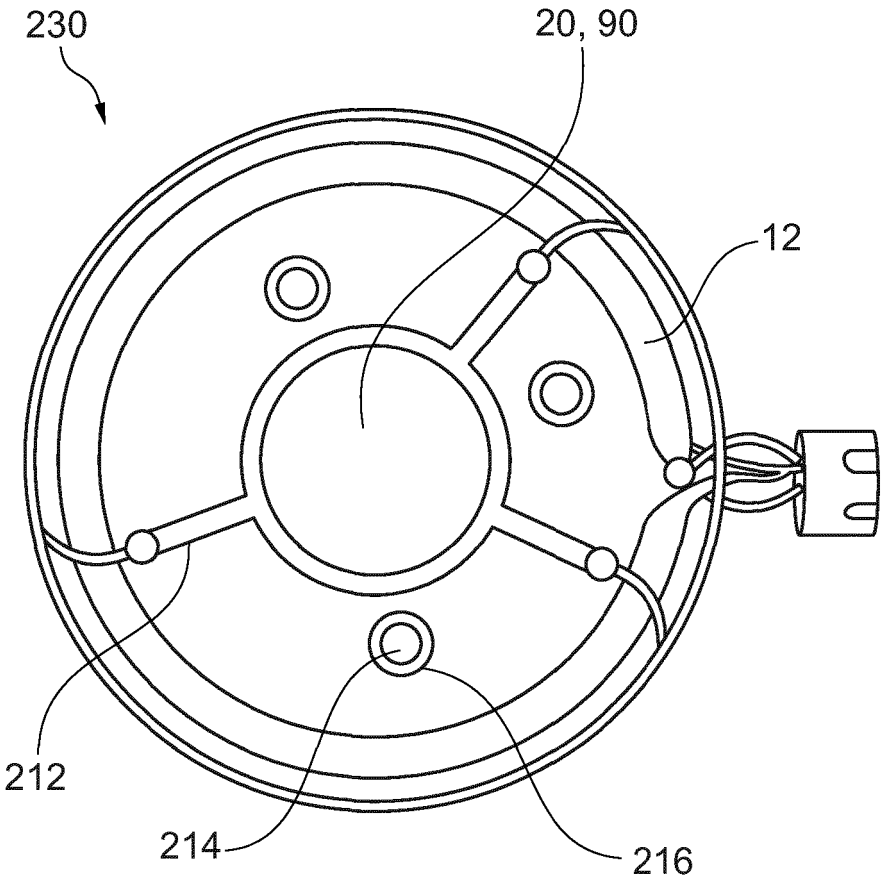

Fig. 6a

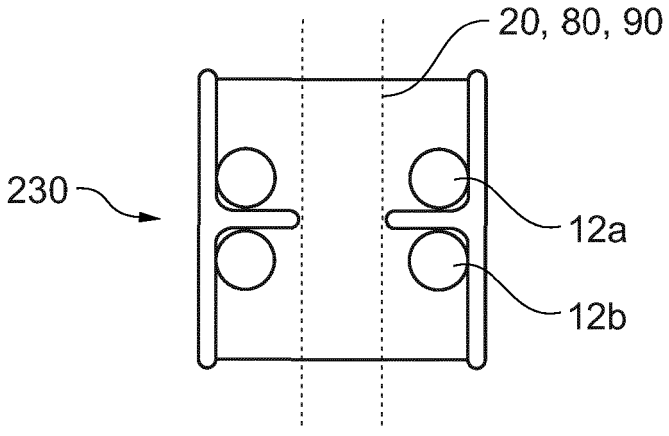

Fig. 6b

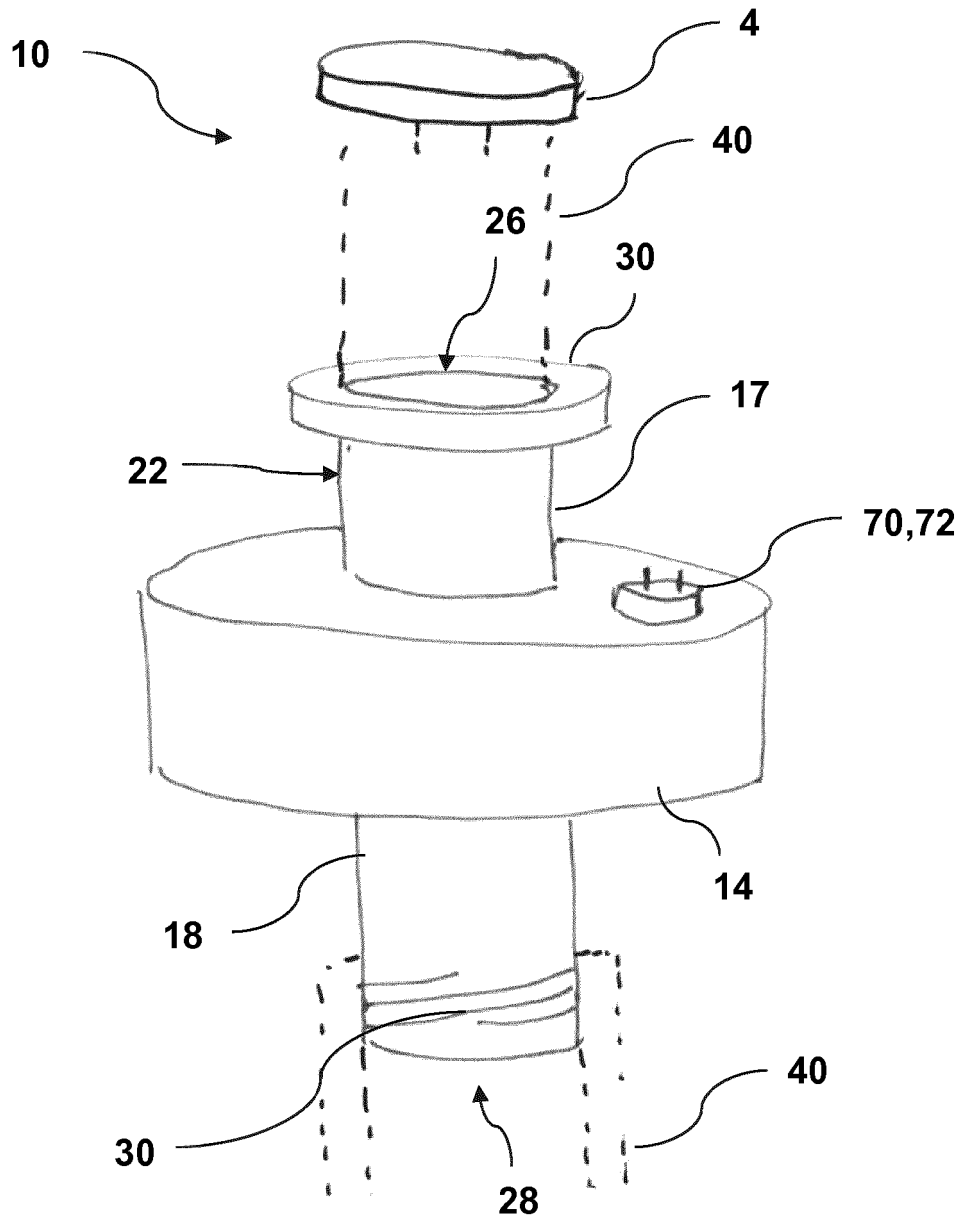

Fig. 7

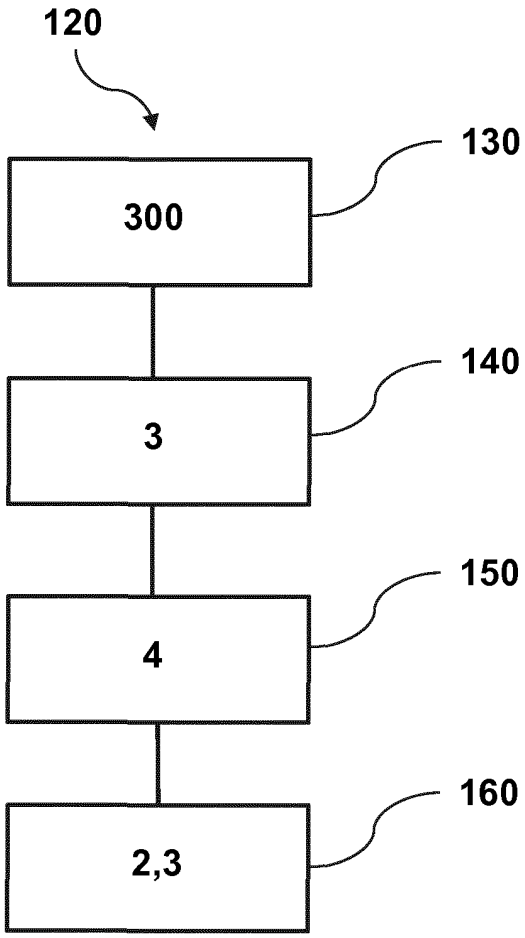

Fig. 8a

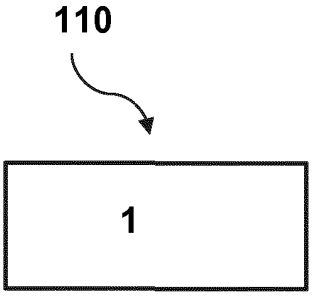

Fig. 8b

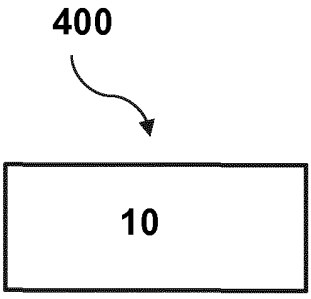

Fig. 8c

Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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