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(54) **METERING SYSTEM FOR DISPENSING AT LEAST ONE FLOWABLE PREPARATION INTO AN INTERIOR OF A WASHING MACHINE**

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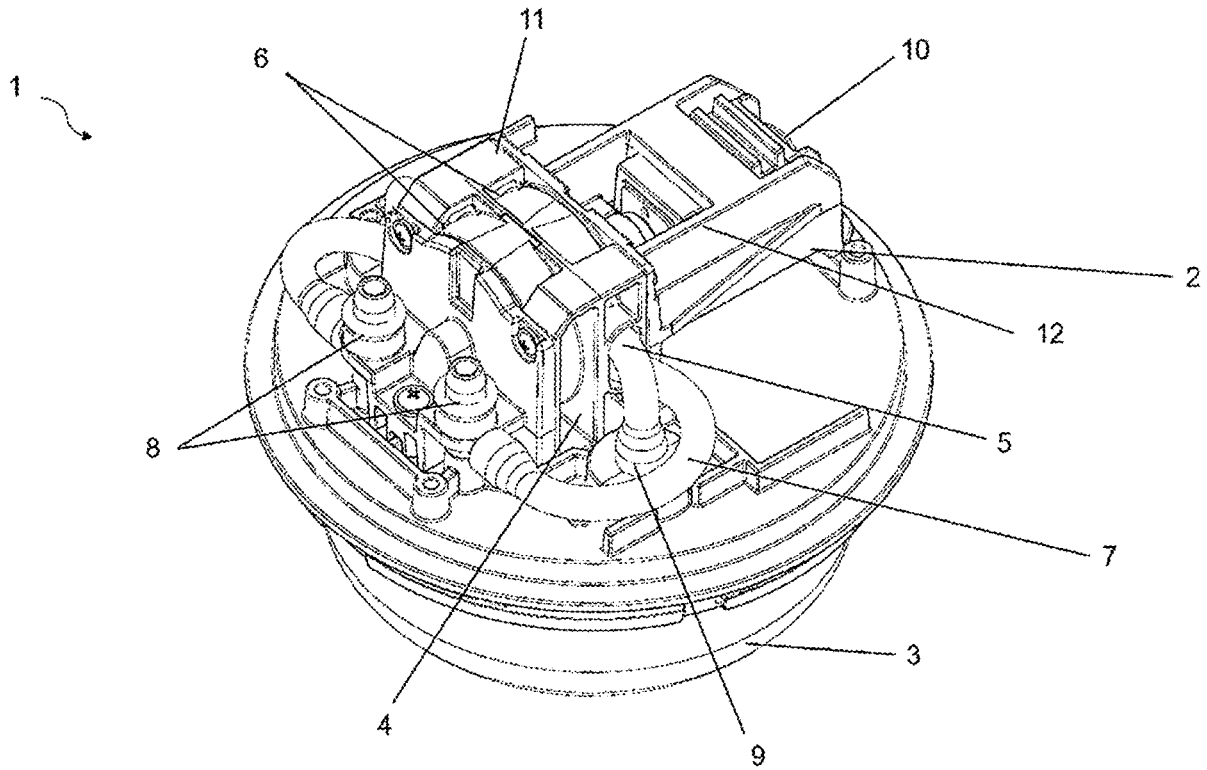
(57) **ABSTRACT**

A metering system for dispensing at least one flowable preparation into an interior of a washing machine, the system having at least one metering device and at least one container which can be coupled to the metering device and is intended for storing the at least one flowable preparation, wherein the metering device includes: at least one electrical power source for operating the metering device; at least one metering unit for dispensing a predefined amount of the at least one flowable preparation; at least one sensor unit for monitoring the metering unit; and at least one control unit coupled to the metering unit and to the sensor unit, wherein the metering unit has a pump for dispensing the at least one flowable preparation and wherein the metering system is suitable for being freely positioned within the interior of the washing machine.



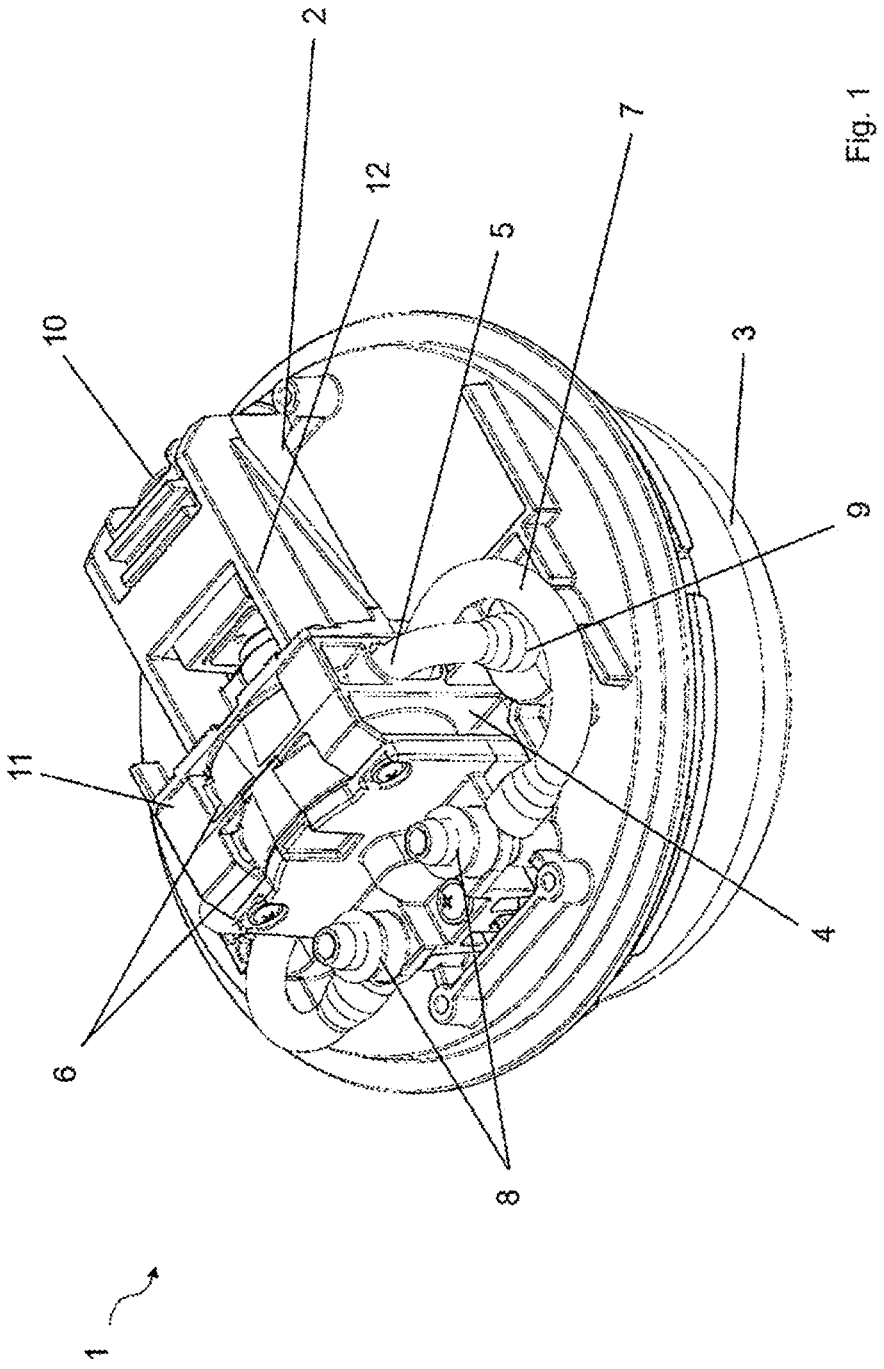


Fig. 1

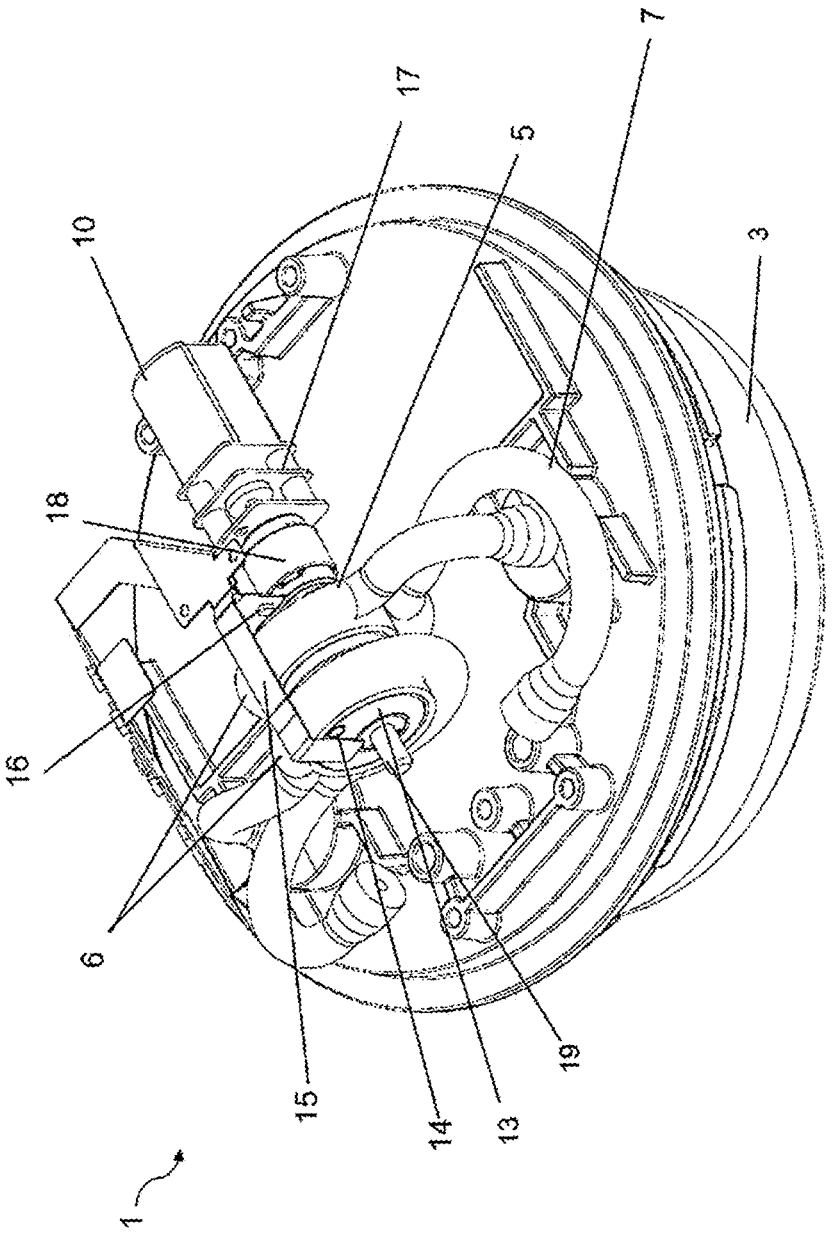


Fig. 2

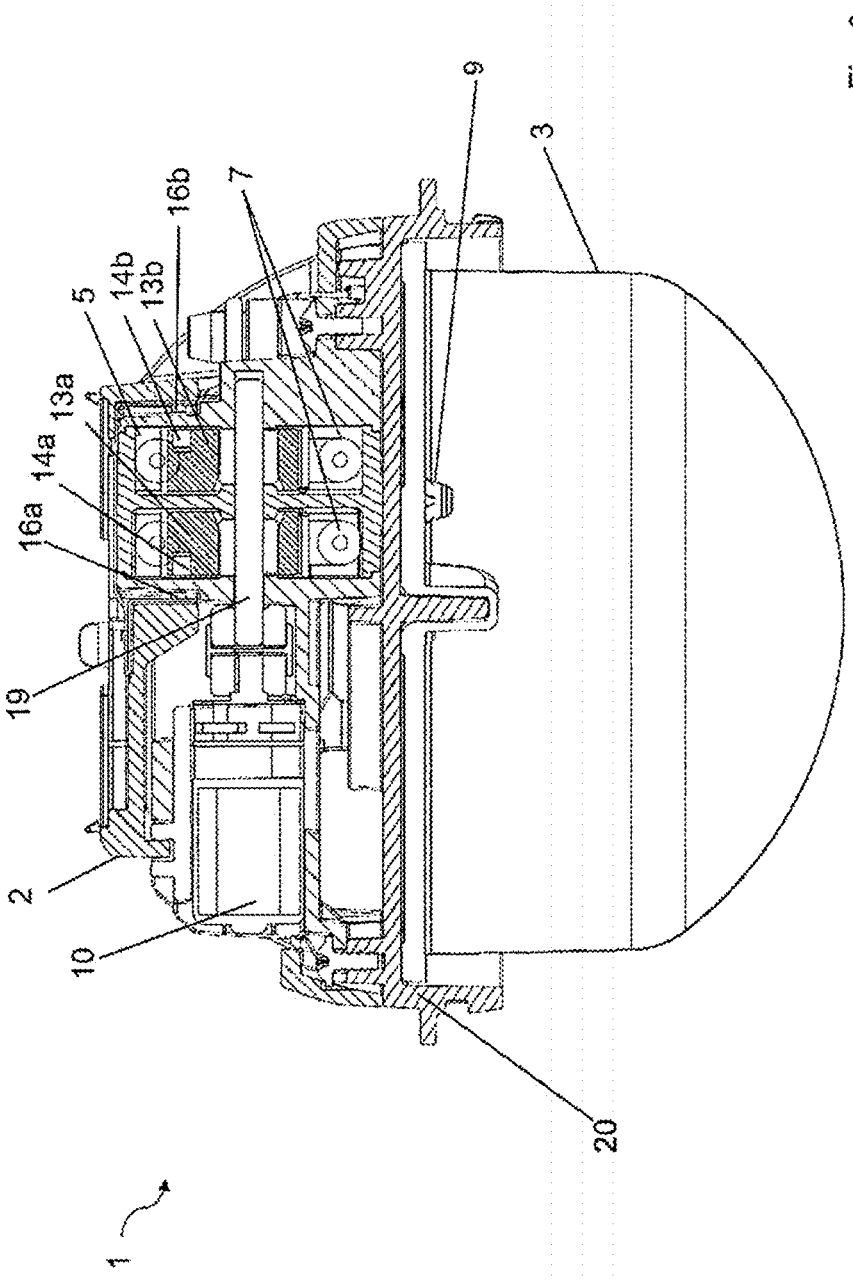


Fig. 3

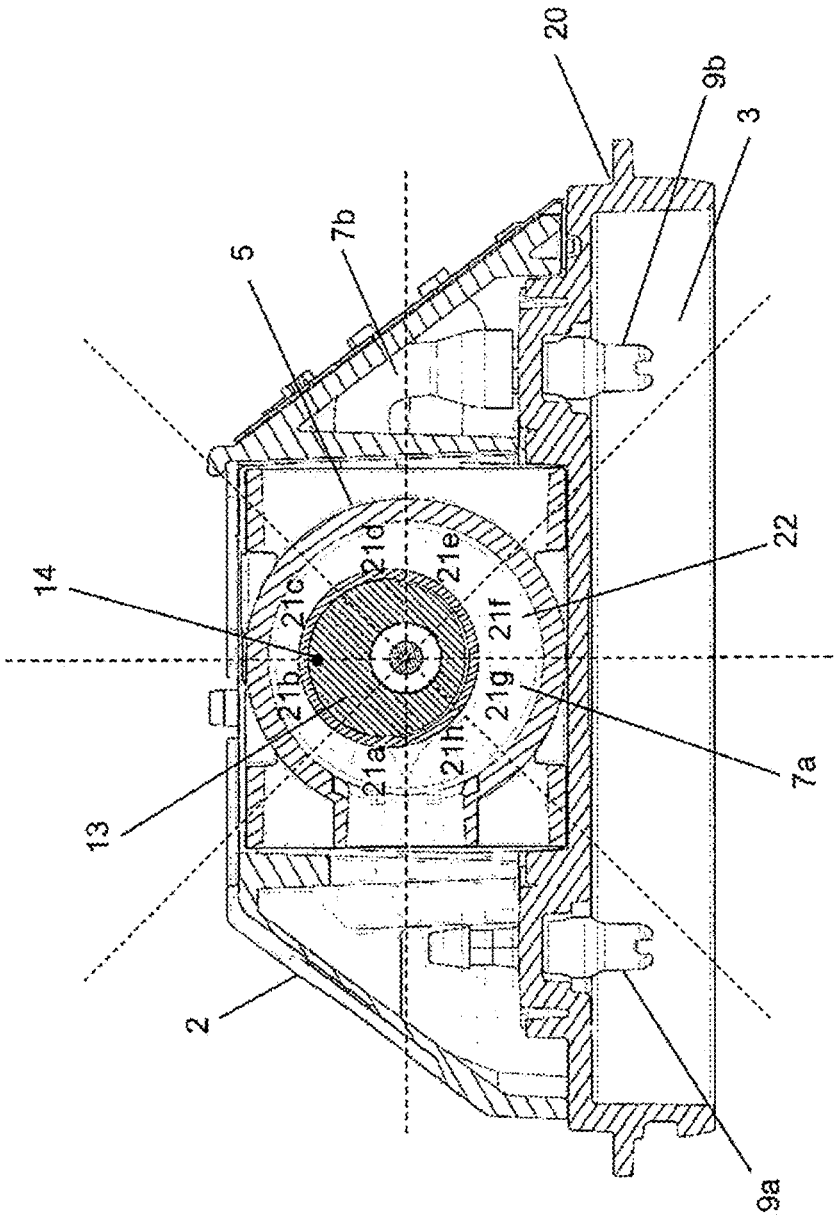


Fig. 4

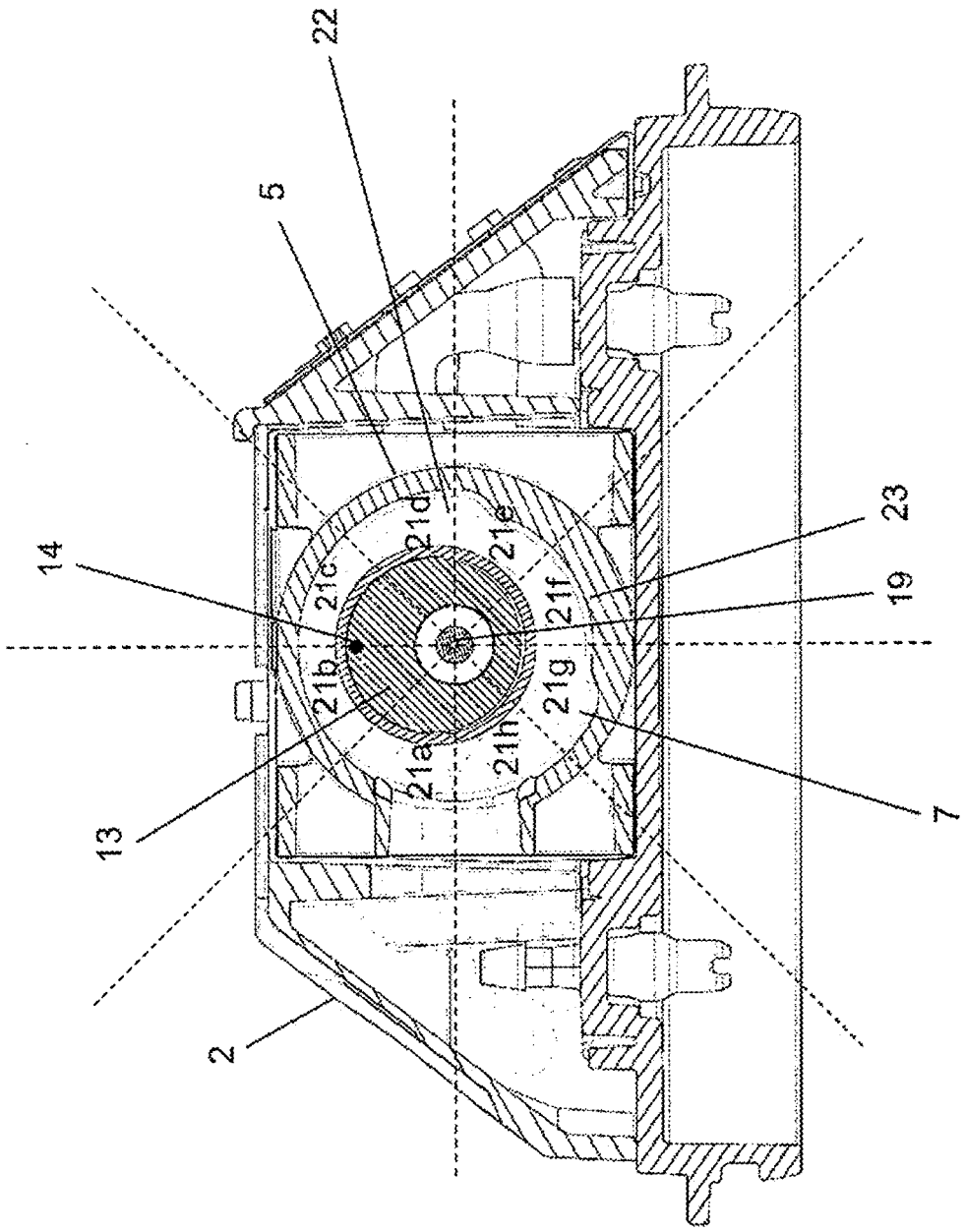


Fig. 5

METERING SYSTEM FOR DISPENSING AT LEAST ONE FLOWABLE PREPARATION INTO AN INTERIOR OF A WASHING MACHINE

FIELD OF THE INVENTION

[0001] The invention relates to a metering system for dispensing at least one flowable preparation into an interior of a washing machine, comprising at least one metering device and at least one container which can be coupled to the metering device and is intended for storing the at least one flowable preparation.

BACKGROUND OF THE INVENTION

[0002] Such metering systems are used for dispensing flowable preparations, such as detergents, in a user-friendly manner and for automating the metering procedure to the greatest extent possible and optimizing the washing result.

[0003] WO 2011/134690 A1 discloses a metering system for use in the interior of a washing machine. A preparation stored in the system for treating laundry in the washing machine is dispensed from a container by the movement of a closure element by means of an actuator.

[0004] WO 2017/167658 A1 describes a metering device for use in the interior of a washing machine, which device has valves which can be opened for metering purposes, if required. In drum washing machines, the laundry is applied to the container wall of the suds container in different phases of the washing process by increasing the drum speed. The speeds reach 400 rpm to 1600 rpm. A high centrifugal force acts on the metering device located in the suds container. The flowable preparations stored in the metering device are also affected by said force. Depending on the position within the suds container, the valves for discharging the product are exposed to high pressure forces (overpressure or negative pressure) in particular during the spinning process. Movable valves with elastic seals are not designed for such pressure loading. The use of valves for metering flowable preparations in metering devices for use in suds containers of washing machines is therefore disadvantageous with respect to safe dispensing and to maintaining the functionality of the metering device. In addition, simple closure elements and valves are not suitable for achieving high metering accuracy, even when very small quantities of the flowable preparation are dispensed.

BRIEF SUMMARY OF THE INVENTION

[0005] It is therefore the object of the invention to provide a metering system for dispensing at least one flowable preparation into an interior of a washing machine which provides high metering accuracy at the same time as functional reliability, even under the effect of high mechanical forces.

[0006] According to the invention, a metering system is proposed according to the features of the claims to achieve this object.

[0007] Advantageous embodiments and further embodiments of the invention are the subject matter of the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** shows an illustration of a metering system according to the invention;

[0009] FIG. **2** shows an illustration of the metering system according to FIG. **1** without a protective housing;

[0010] FIG. **3** shows a cross section through the metering system according to FIG. **1**;

[0011] FIG. **4** shows a cross section through a pump of the metering system according to FIG. **1**; and

[0012] FIG. **5** shows a cross section through a pump of the metering system according to FIG. **1** with a receptacle that is narrowed in regions.

DETAILED DESCRIPTION OF THE INVENTION

[0013] According to the invention, a metering system is provided for dispensing at least one flowable preparation into an interior of a washing machine and comprises at least one metering device and at least one container which can be coupled to the metering device for storing the at least one flowable preparation. The flowable preparation can be, for example, a detergent, detergent component, scenting agent, bleaching agent or solvent. The container that can be coupled to the metering device is preferably designed such that it offers sufficient space for storing the at least one flowable preparation sufficiently for a plurality of washing processes, particularly preferably sufficiently for 5 to 25 washing processes. The metering device has at least one electrical power source for operating the metering device. For example, it can be designed as one or more batteries or rechargeable batteries, for example lithium polymer batteries, and supplies the further components of the metering device with electrical power. The metering device also comprises at least one metering unit for dispensing a predefined quantity of the at least one flowable preparation, at least one sensor unit for monitoring the metering unit, and at least one control unit coupled to the metering unit and the sensor unit. The metering unit has a pump for dispensing the at least one flowable preparation. In addition, the metering unit can preferably have a motor and a gear mechanism for driving the pump. The electrical power source of the metering device can thereby supply the motor with electrical power in order to ensure a smooth dispensing process.

[0014] The metering system is suitable for being freely positioned within the interior of the washing machine; said metering system is preferably suitable for being freely positioned within the suds container of a drum washing machine. Said metering system is preferably designed to be stable enough to withstand spinning processes within the washing machine of 100 rpm, particularly preferably up to 1600 rpm, without being damaged. Due to the design of the metering unit comprising a pump, said unit is suitable for continuing to reliably dispense said preparation with a gravitational force of >1 g and simultaneously for sealing against undesired escape of the flowable preparation and against ingress of air and/or water into the metering system. For its protection, it can, for example, have one or more protective housings for individual components of the metering system in order to protect sensitive components from damage due to mechanical action.

[0015] According to one proposal of the invention, the pump is designed as a peristaltic pump. Peristaltic pumps offer the advantage that they reliably function even under the effect of high external forces, as occur, for example, during a washing process inside the suds container. With a metering unit designed in this way, it can be ensured that reliable, accurate metering is possible at any time. In addition, high

metering accuracies can be achieved with peristaltic pumps even in the case of very small dispensing quantities in the milliliter range and in the sub-milliliter range.

[0016] According to a further proposal of the invention, the peristaltic pump comprises a rotary body which is mounted eccentrically within a receptacle for conveying the at least one flowable preparation through a pump hose. The pump hose is mounted in the receptacle so as to surround the rotary body. Due to the eccentric mounting on a shaft, for example in the form of a pump shaft, the part of the rotary body which, starting from the shaft, has the greatest extent compresses a portion of the pump tube the most. If the rotary body, which is driven by the shaft connected to the gear mechanism and the motor of the metering unit, is rotated about said shaft, the point of maximum loading on the pump tube moves with the rotation too. In this case, the rotary body continuously conveys the flowable preparation located in the pump hose through said hose. An exact flow rate can be determined by the rotational speed and the frequency with which the rotary body rotates and can be set by the control unit depending on requirements.

[0017] According to a further proposal of the invention, the rotary body can be controlled by the control unit by means of at least one signal transmitted by the sensor unit. The sensor unit can detect the position of the rotary body and transmit it to the control unit for comparison. The control unit can then in turn output a control command to the metering unit that is adapted to the desired quantity of the flowable preparation to be dispensed and the current angular position of the rotary body so that metering accuracy is constantly high.

[0018] According to a further proposal of the invention, the sensor unit has at least one Hall sensor and the rotary body has at least one magnet. The position of the eccentric rotary body can be detected easily and accurately by means of the Hall sensor. As soon as the magnet located at a predetermined position on the rotary body passes through the detection range of the Hall sensor, the exact position of the rotary body can thus be determined. In combination with a predetermined rotational speed, it is possible to always allow the rotary body to rotate into a desired position and thus to dispense precisely the desired quantity of flowable preparation, which is preset for the metering unit by the control unit. In a preferred embodiment, the magnet is located in the region of the rotary body which compresses the pump tube the most. This embodiment is characterized by its functional reliability even when high forces are applied, for example at an increased rotational speed of the suds container.

[0019] According to a further proposal of the invention, the rotary body can be moved by the control unit into a valve position for sealing the peristaltic pump. In order to prevent undesired dispensing and/or damage to the metering system, the metering unit must be sealed. It must be avoided here that the environmental influence in the form of overpressure or negative pressure situations, which arise depending on the position of the metering system in the rotating suds container, cannot have an effect back on the metering system. In particular, the container for storing the flowable preparation must be protected in order to avoid damage. Undesired dispensing in the event of a negative pressure has to be avoided as well as the entry of air and/or washing water into the container in the event of overpressure. This can advantageously be resolved by the rotary body. In the valve position, said rotary body can serve for sealing the metering system. In the valve position, the rotary body is at a standstill and maximum compression of the pump hose is preferably located in a region of the receptacle which is as far away as possible from an inlet of the pump hose into the receptacle and the outlet thereof out of the receptacle. For this purpose, the motor of the metering unit continues to run after completion of a metering process until the desired standstill and valve position is reached. In order to be able to determine a position that is as precise as possible, the motor preferably runs until the magnet passes the Hall sensor once more and can be positioned precisely starting therefrom. A certain amount of switching hysteresis ensures that the rotary body stops and assumes its valve position in a region of the receptacle in which secured sealing against external effects can take place.

[0020] According to a further proposal of the invention, the receptacle of the peristaltic pump is narrowed in places. In this embodiment, the loading of the pump hose by compression is targetedly reduced in that the maximum load and thus also most effective sealing takes place only in a predetermined portion of the receptacle. Compression of the pump hose is greater in the region of the receptacle which is narrowed compared to the remaining regions. Due to the increased compression only in places, the service life of the pump tube can advantageously be extended, which overall increases the service life of the metering system, since replacement of individual small components of the metering system is unprofitable in practice and, in addition, is often simply not possible for the user. The receptacle is preferably substantially round and is narrowed in places by the reduction of its radius in regions. The pump tube, which is placed around the rotary body, substantially runs on a circular path along the inner wall of the receptacle. Preferably, the receptacle is narrowed in the region which, during dispensing from the inlet in the conveying direction of the flowable preparation toward the outlet of the pump hose, is at approximately 180°-300°. With the aid of the Hall sensor and the magnet and a predefined time period for reaching this region, an optimal valve position of the rotary body and thus maximum sealing of the metering system can thus be ensured.

[0021] According to a further proposal of the invention, the container is suitable for separate storage of at least two flowable preparations. This offers the advantage of being able to provide a plurality of flowable preparations during a washing process using a single metering system. For this purpose, the container can have, for example, a plurality of cavities in which the flowable preparations are stored separately. However, it is also conceivable for the metering system to have a plurality of separate containers for storing flowable preparations.

[0022] For example, it is then possible to provide a metering unit with a plurality of pumps or a plurality of metering units each having a pump in order to dispense a plurality of flowable preparations stored separately from the container into the suds container of the washing machine, increasing the user-friendliness of the metering system. In this way, it is possible, for example, to separately dispense flowable preparations one after the other in different stages of the washing process, without these being able to negatively influence one another's effect, such as detergents and fragrances, for example. In addition, it is possible to dispense two or more flowable preparations within one stage of the

washing process so that they react with one another and can only optimally interact in the suds container.

[0023] According to a further proposal of the invention, the peristaltic pump comprises a double head. This offers the advantage that two flowable preparations can be dispensed using only one metering unit, one motor, one gear mechanism, and one pump shaft. This offers the advantage that the metering unit takes up as little space in the metering device as possible, even though a plurality of flowable preparations can be dispensed, since dual provision of the motor, gear mechanism or pump shaft is thus superfluous.

[0024] According to a further proposal of the invention, the peristaltic pump comprises a bidirectional freewheel. For example, when the double head is used in combination with the bidirectional freewheel with only one pump, two flowable preparations can be dispensed in one go. Due to the freewheel, interference-free changing is possible, so that, depending on the direction of rotation of the pump shaft, only a first or a second pump head of the double head is in operation and the first or the second flowable preparation is dispensed. At the same time, the bidirectional freewheel prevents the other flowable preparation from simultaneously being accidentally dispensed or a reflux from occurring.

[0025] According to a further proposal of the invention, the metering system comprises a substantially spherical outer shell which is suitable for accommodating the metering device and the container. The spherical design offers the advantage that force is uniformly distributed on the metering system, increasing the service life of the metering system. It is also advantageous to design the metering system in such a way that the container for storing the flowable preparation can be detachably coupled to the metering system. As soon as the container or a cavity of the container is emptied, the container can be removed by the user and refilled or replaced. The outer shell also has an opening for each flowable preparation for the purpose of dispensing it.

[0026] FIG. **1** shows a metering system **1** according to the invention comprising a metering device **2** and a container **3**. A metering unit **4** has a pump **5** which in this embodiment is designed as a peristaltic pump. In this embodiment, the pump **5** is also designed as a double-head pump having a double head **6**. This enables separate metering of two flowable preparations which are stored in different cavities of the container **3** that are separated from one another. A flowable preparation is dispensed into the interior of the washing machine at each outlet **8**, which preparation is guided from the container **3** into a pump tube **7** via an inlet **9**. A motor **10** of the metering unit **4** drives the pump **5**. The motor **10** is protected from harmful external influences by a motor protection housing **12**.

[0027] Likewise, the pump **5** is protected by means of a pump protection housing **11**. The metering system **1**, which preferably has an outer shell (not shown) for protecting the container **3** and the metering device **2**, is placed by the user together with the laundry to be washed in the suds container of the washing machine. The metering system **1** preferably has an interface for receiving metering commands. For example, the metering system **1** can be controlled by the user by means of a smartphone app. Different washing programs and meterings can be set in the app. In addition, two-way communication is advantageous; thus, the metering system **1** can, for example, have additional sensors which detect the exact position of the metering system **1** in the washing machine, the presence of water and the amount of laundry in the suds container, and transmit this information. In this way, precise metering can be carried out depending on the amount of laundry, the flowable preparation, the washing program, and the individual treatment step of the washing process.

[0028] FIG. **2** shows the metering system **1** according to FIG. **1** in a view not comprising a protective housing so that a sensor unit **15** which extends over the double head **6** is visible. For each pump head of the double head **6**, a Hall sensor **16** is provided which detects the rotational position of the rotary body **13** by means of a magnet **14** attached to a rotary body **13**. The motor **10** is connected to a gear mechanism **17** and a bidirectionally acting freewheel **18**, which makes it possible for a pump shaft **19** to be moved with a change in direction so that the pump **5** with the double head **6** can dispense two liquid preparations taken from the container **3** individually and separately from one another via the pump hoses **7**.

[0029] FIG. **3** shows a cross section of the metering system **1** according to FIG. **1**. The container **3** is detachably coupled to the metering device **2** in a container receptacle **20**. This has the advantage that the container **3** can be replaced or refilled and can be inserted back into the metering system **1**. A leak-proof connection between the container **3** and the metering device **2** is ensured when said container is fixed in the container receptacle **20**. Only via the inlet **9** can the flowable preparation escape from the container **3** and pass via the pump hose **7** into the pump **5** when said pump is driven by means of a motor **10** and the pump shaft **19** and draws the flowable preparation out of the container **3**. The two rotary bodies **13***a, b* each have magnets **14***a, b*, which are each detected by the two Hall sensors **16***a, b* in order to precisely detect the position of the rotary bodies **13***a, b* when they pass the Hall sensors **16***a, b*. A consistently high degree of metering accuracy is thus ensured for both flowable preparations to be dispensed.

[0030] FIGS. **4** and **5** each show a cross section through a pump **5** of the metering device **2**. FIG. **4** shows a receptacle **22** of the pump **5** for the pump hose **7***a* for a first flowable preparation, with pump segments **21** *a-h* having a constant segment radius. In the region of pump segment **21***a*, the flowable preparation running into the pump hose **7***a* via the inlet **9***a* enters the pump **5** and leaves it again in the region of pump segment **21***h*. Due to the circular movement of the eccentrically mounted rotary body **13**, the flowable preparation is pressed within the pump hose **7***a* through pump segments **21***a-h*. In the region of pump segments **21***b*, **21***c* and **21***d*, the flowable preparation, which enters the pump **5** in pump segment **21***a*, is drawn out of the container **3** fixed in the container receptacle **20** and discharged again in the region of pump segments **21***e-h*. Except for in the region of pump segments **21***a* and **21***h*, the rotary body **13** changes in which region it places load on the pump hose **7***a* during its rotation. In the regions of the compression, it also seals the pump hose **7***a* off from the surroundings. By means of the magnet **14**, the sensor unit can precisely detect the position of the rotary body **13**, which is important with regard to metering accuracy. While the first flowable preparation which enters the pump **5** via the inlet **9***a* is being metered, the pump head, which is connected to the inlet **9***b* with the second flowable preparation via the pump hose **7***b*, is stopped. In this way, inadvertent dispensing of the second flowable preparation together with the first flowable preparation from the metering system **1** can be prevented.

[0031] In FIG. **5**, the receptacle of the pump **5** of the metering device **2** has, in pump segments **21***e-g*, a segment radius that is smaller than the region of pump segments **21***a-d* and **21***h* so that a step **23** extends over this region of the wall of the receptacle **22**. In this region, maximum loading is placed on the pump hose **7**. In the remaining segments, the pump hose **7** is compressed and thus loaded to a lesser extent, which extends the service life of the pump hose. In addition, sealing is best ensured in these segments. With the aid of the Hall sensor, which accurately detects the position of the rotary body with the aid of the magnet **14** and forwards this signal to a control unit, the rotary body **13** can be rotated further by means of the pump shaft **19** after the metering process has ended until it comes to a standstill in the narrowed region of the receptacle **22** where it assumes a valve position. Sealing of the metering system **1** can be most effectively ensured in this region, because compression of the pump hose **7** is maximized here.

LIST OF REFERENCE SIGNS

[0032] **1** Metering system
[0033] **2** Metering device
[0034] **3** Container
[0035] **4** Metering unit
[0036] **5** Pump
[0037] **6** Double head
[0038] **7** Pump tube
[0039] **8** Outlet
[0040] **9** Inlet
[0041] **10** Motor
[0042] **11** Pump protection housing
[0043] **12** Motor protection housing
[0044] **13** Rotary body
[0045] **14** Magnet
[0046] **15** Sensor unit
[0047] **16** Hall sensor
[0048] **17** Gear set
[0049] **18** Freewheel
[0050] **19** Pump shaft
[0051] **20** Container receptacle
[0052] **21** Pump segment
[0053] **22** Receptacle
[0054] **23** Step

What is claimed is:

1. A metering system for dispensing at least one flowable preparation into an interior of a washing machine, which system is suitable for being freely positioned within the interior of the washing machine and comprises:
- at least least one metering device and
- at least one container which can be coupled to the metering device for storing the at least one flowable preparation,

wherein the metering device has
- at least one electrical power source for operating the metering device,
- at least one metering unit for dispensing a predefined quantity of the at least one flowable preparation,
- at least one sensor unit for monitoring the metering unit, and
- at least one control unit coupled to the metering unit and the sensor unit, and

wherein the metering unit has a peristaltic pump for dispensing the at least one flowable preparation.

2. The metering system according to claim **1**, wherein the peristaltic pump comprises a rotary body which is eccentrically mounted within a receptacle for conveying the at least one flowable preparation through a pump hose.

3. The metering system according to claim **2**, wherein the control unit can control the rotary body using at least one signal transmitted by the sensor unit.

4. The metering system according to claim **2**, wherein the sensor unit has at least one Hall sensor and the rotary body has at least one magnet.

5. The metering system according to claim **2**, wherein the rotary body can be moved by the control unit into a valve position for tightly sealing the peristaltic pump.

6. The metering system according to claim **1**, wherein the receptacle of the peristaltic pump is narrowed in places.

7. The metering system according to claim **1**, wherein the container is suitable for the separate storage of at least two flowable preparations.

8. The metering system according to claim **1**, wherein the peristaltic pump comprises a double head.

9. The metering system according to claim **1**, wherein the peristaltic pump comprises a bidirectional freewheel.

10. The metering system according to claim **1**, wherein the metering system comprises a substantially spherical outer shell which is suitable for receiving the metering device and the container.

* * * * *