United States Patent [19]

Brouwer et al.

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[45] **Sept. 25, 1973**

[54] **DOSING DEVICE**

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[30] **Foreign Application Priority Data**

Mar. 31, 1972 Netherlands 7104264

[52] **U.S. Cl.** **222/411,** 222/413, 222/442

[51] **Int. Cl.** **G01f 11/20**

[58] **Field of Search** 222/410, 411, 368, 222/403, 413, 548, 442, 444; 202/236, 238

[56] **References Cited**

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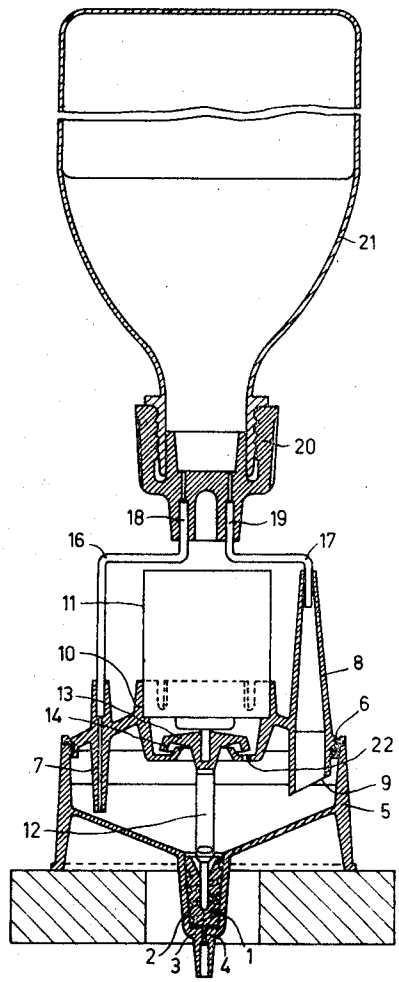
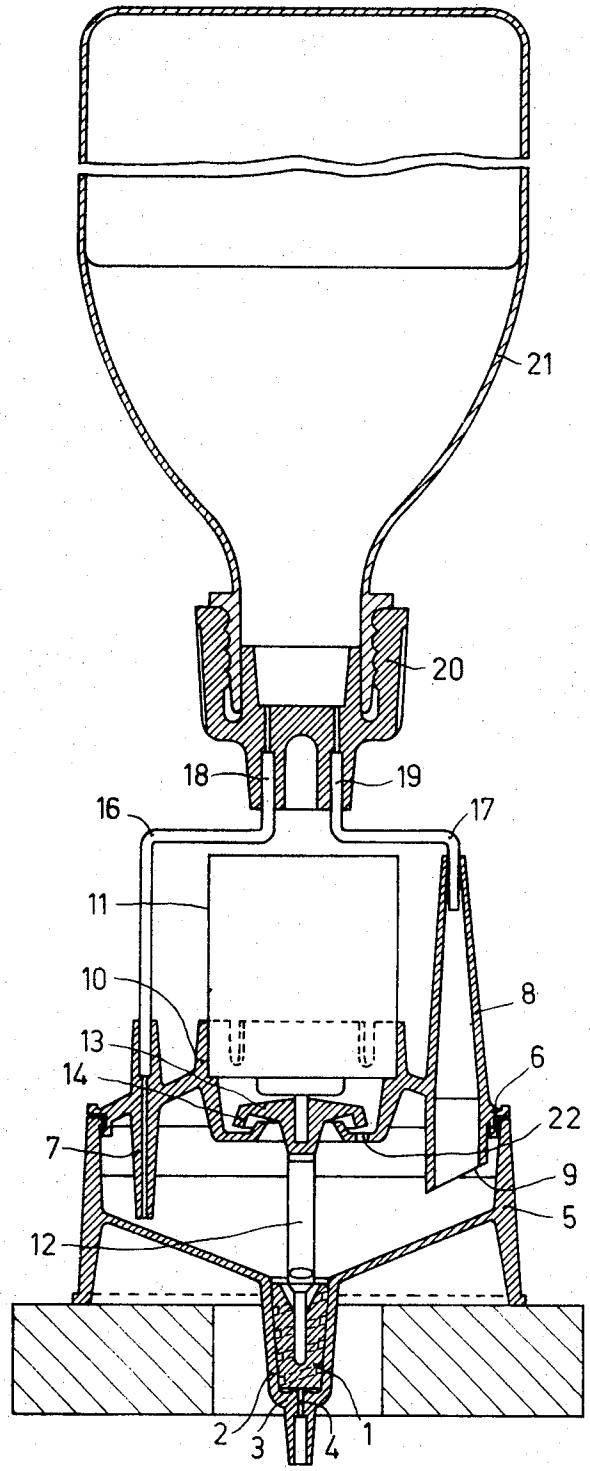
Assistant Examiner—H. Grant Skaggs, Jr.
Attorney—Frank R. Trifari

[57] **ABSTRACT**

A dosing device for the pulse-free and continuous supply of a very accurate small flow of liquid comprising a rotor which is enveloped by a housing and is coupled to a motor. The rotor has shallow liquid pumping grooves and is vertically arranged. One side of the housing is closed by a wall having an outlet aperture and the other side communicates with an auxiliary container. The container has a cover plate carrying two tubes extending into the container. One tube extends deeper down in said container than the other, and is cut off at an angle, and is wider than the first tube. Both tubes are capable of communication with a closed container having the liquid to be dosed.

4 Claims, 1 Drawing Figure

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DOSING DEVICE

The invention relates to a dosing device for the pulse-free and continuous supply of very accurately determined very small quantities of medium per unit time, The device has a rotor enveloped by a housing and coupled to a driving mechanism. The faces of rotor or housing facing each other have shallow liquid pumping grooves. Dosing devices of the above-indicated type are known. This type of dosing devices is used, for example, in the microanalysis and in the automation of chemical analyses. The quantities to be dosed are very small and cover the range from 30 cm^3 per second to quantities smaller than 1 mm^3 per second. The liquid is forced to the pump outlet upon rotation of the rotor by the occurring viscous forces through the helically extending pumping grooves. It will be obvious that with the indicated very small quantities and the desirable great accuracy it is of importance to maintain the pressure on the inlet side of the pump as constant as possible.

The invention provides an improved construction of a dosing device of the above-indicated type which is characterized in that the rotor with enveloping housing is arranged vertically, one end of the housing being closed by a wall having an outlet aperture and the other end of the housing communicating with an auxiliary container. The container has a cover plate in which two tubes are incorporated the first of which extends deeper down in the auxiliary container than the second tube. The second tube is wider than the first tube and its end within the auxiliary container is cut off at an angle. The two tubes are capable of communication, if desirable via ducts, with the lower side of a closed container comprising the dosing liquid.

As long as the level of the liquid in the auxiliary container is below the end of the second tube, air can be drawn from said auxiliary container to the container comprising the liquid to be dosed. As a result of this the negative pressure in the container is too low so that liquid flows from said container via the first tube into the auxiliary container. As soon as the liquid in the auxiliary container also closes the second tube, a pressure will adjust above the liquid in the container comprising the liquid to be dosed such that the supply of liquid to the auxiliary container is discontinued. When the level of the liquid in the auxiliary container again falls below the end of the second tube by the removal of liquid from said container by the pump, air can again flow to the container comprising the liquid to be dosed, as a result of which the negative pressure above said liquid becomes smaller and liquid flows again to the auxiliary container. In this manner the liquid level in the auxiliary container varies only very little so that a substantially constant inlet pressure for the pump is obtained.

The container which comprises the liquid to be dosed may be constituted by a bottle as it can be normally obtained from the supplier. Such a bottle should have a stopper which has two apertures which can be made to communicate with the first and the second tube. The driving mechanism may be an electric motor arranged on the cover plate and coupled to the rotor via a flexible shaft. As a result of the flexible shaft, no great accuracy requirement need be imposed upon the alignment of the rotor housing and the motor. With this arrangement it is furthermore possible to tilt the assembly of motor, shaft and rotor, which facilitates assembly and

dismantling. This point is also of great importance in a further embodiment of the invention in which the rotor has a slightly conical construction. By slightly tilting the rotor and lowering it again, any air inclusions can be removed. An additional advantage of a conical shape of the rotor is that it can be manufactured from a synthetic material in a self-detaching mould.

In order to prevent the liquid to be dosed, which is sometimes agressive, from spirting out of the auxiliary container to the motor, the shaft which is passed through the cover plate may be provided with a dish-like plate having an edge which is bent towards the cover plate.

The invention will be described in greater detail with reference to the drawing, which is a sectioned elevational view of the invention.

Reference numeral **1** in the drawing denotes a rotor. The rotor **1** is surrounded by a housing **2** which is sealed on the lower side by a wall **3** having an outlet aperture **4.** The housing **2** comprises on its inside a pattern of shallow helical grooves.

An auxiliary container **5** comprising a cover plate **6** is connected to the upperside of the housing **2.** Incorporated in the cover plate **6** are a first tube **7** which container and a second tube **8** which terminates at a higher level in the auxiliary container. The end **9** of the second tube **8** in the auxiliary container **5** is cut off at an angle, while the tube **8** furthermore is wider than the tube **7** and has a spigoted end.

The cover plate **6** furthermore comprises a seating **10** on which an electric motor **11** is arranged. This electric motor **11** is connected to the rotor **1** via a flexible shaft **12.**

A dish-like plate **13** of which the bent edge **14** is directed towards the cover plate **6** is provided on the shaft **12** passed through the cover plate. The tubes **7** and **8** communicate via ducts **16** and **17,** respectively, with two connections **18** and **19** in the stopper **20** of a bottle **21** which is arranged upside down and comprises the liquid to be dosed.

The operation of this dosing device is as follows. By rotation of the rotor **1** by means of the electric motor **11,** liquid is pumped to the outlet **4** by the occurring viscous forces through the pattern of helical grooves. When the liquid level in the container **5** falls below the end **9** of the tube **8,** air from the container **5** can flow to the bottle **21** so that in said bottle a smaller negative pressure adjusts above the liquid than corresponds to the hydrostatic pressure equilibrium. As a result of this liquid flows from the bottle **21** via duct **16** and tube **7** into the container **5** until the liquid level again closes the end **9** of the tube **8.** In this manner a substantially constant liquid level is maintained in the auxiliary container **5,** which means that the initial pressure before the rotor **1** does substantially not vary either so that the dosing device is very accurate in operation also in the case of low numbers of revolutions of the rotor.

When the bottle **21** is empty, it may be replaced by a new one without interrupting the dosing. During said replacement of the bottle, the pump operates with the liquid still present in the auxiliary container **5.**

As a result of the conical construction of the rotor **1,** any air inclusions can easily be removed by slightly tilting the assembly of motor **11,** shaft **12** and rotor **1** for a minute.

The sometimes agressive liquid in the container **5** can not reach the motor **11** because spirting liquid is inter-

cepted by the plate 13 where said drops of liquid are then centrifuged against the edge 14 and returned to the cover plate. The liquid can flow back to the container 5 through aperture 22.

In this manner a very accurately operating dosing device of a simple construction is obtained.

What is claimed is:

1. A dosing device for providing a continuous supply of accurately determined quantities of dosing medium per unit of time comprising a housing, a lower wall having an outlet aperture closing one end of said housing, a vertically arranged rotor rotatably mounted within said housing, driving means coupled to said rotor for rotatably driving said rotor, a plurality of shallow liquid pumping grooves about the circumferential surface of said rotor, an auxiliary container communicating with the other end of said housing, a cover plate covering said auxiliary container, first and second liquid tubes carried by said cover plate, one end of each tube extending into said auxiliary container, said first tube being thinner than and extending deeper into said container than said second tube, said end of said second tube extended in said container having a truncated open end, the other end of said first and second tubes communicating with a supply of liquid to be dosed.

2. The dosing device according to claim 1 wherein said driving means is an electric motor carried on said cover plate and coupled to said rotor by a flexible shaft.

3. The dosing device according to claim 1 wherein said rotor has a conical cross-section.

4. The dosing device according to claim 1 wherein said rotor is coupled to said driving means by a shaft passing through said cover plate, and further comprising a dish-shaped plate carried by said shaft having one edge thereof bent towards said cover plate.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3760991 Dated Sept. 25, 1973

Inventor(s) GEERT BROUWER ET AL

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading:

Foreign Application Priority Date should read

--March 31, 1971--

Signed and sealed this 2nd day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents