Nozzle for dispensing concrete, mortar or the like

The present invention relates to a nozzle for dispensing concrete, mortar or the like. Such nozzles are generally known, for example in connection with the processing of sprayed concrete. If rapid curing of the concrete, mortar or the like to be processed is desired, an additive, which is ideally already mixed intimately in the nozzle with the concrete, mortar or the like to be dispensed, can be added to the concrete, mortar or the like shortly before dispensing.

A nozzle of this kind is known from EP 3 431 172 A1, which nozzle can be used with suitable dimensioning of a mixing tube acting as a mixing chamber also for 3D printing of concrete, mortar or the like. The problem generally exists with such nozzles that on account of the admixed additive, which accelerates the curing of the concrete, mortar or the like, deposits can form increasingly inside the nozzle, in particular if the flow through the nozzle is stopped temporarily and then resumed again. These relatively rapidly solidifying deposits can disrupt the proper operation of the nozzle up to the point of total failure.

An aspect of the invention has the features indicated in Claim 1.

In one exemplary arrangement, the nozzle has a housing and a mixing chamber, which is arranged therein and is delimited by a circumferential wall and extends along a longitudinal axis at least between a supply opening and an outlet opening. Located in the mixing chamber is an actively driveable mixing device. The nozzle further has an exit opening, which is directly or indirectly flow-connected to the outlet opening. At least one cavity, which extends axially and in the circumferential direction, is formed around the circumferential wall of the mixing chamber and is in contact with the circumferential wall and at least substantially surrounds the mixing chamber in the circumferential direction. By “at least substantially surrounds in the circumferential direction” it is meant here that the at least one cavity surrounds the greatest part of the circumference of the mixing chamber or even extends completely around the mixing chamber. Minor interruptions in this extension are harmless, however, as will be explained below. By “in contact with the circumferential wall” it is meant here that the outside of the circumferential wall delimiting the mixing chamber

forms at least a portion of the inner delimitation of the cavity. The circumferential wall of the mixing chamber further consists of elastic material, which can deform into the at least one cavity in operation of the nozzle. Natural and synthetic rubber or caoutchouc materials, for example, are suitable as elastic material for the circumferential wall of the mixing chamber, likewise elastic plastics and similar. The elasticity of the elastic material used is selected depending on the substances to be dispensed using the nozzle such that the pressures and stresses occurring in the mixing chamber during operation of the nozzle and acting on the circumferential wall of the mixing chamber lead to temporary, at least local deformations of the mixing chamber circumferential wall into the at least one cavity. It is thus understood that said deformations of the mixing chamber circumferential wall are not permanent deformations, but are reversible deformations such that the circumferential wall of the mixing chamber repeatedly reverts to its original state following termination of the operation of the nozzle. It is also understood that the elastic material must be selected with respect to its properties such that it can withstand the stresses occurring in operation of the nozzle (with regard to stability, chemical resistance, abrasion resistance etc.).

Therefore, it may be possible to obtain a nozzle for dispensing concrete, mortar or the like that is more tolerant and thus less susceptible to disruption with respect to such deposits forming in it.

In one exemplary arrangement, the aforesaid at least one cavity is present in any case in the operating state of the nozzle. Configurations are conceivable in which the at least one cavity no longer exists in a resting state of the nozzle and is only produced in the operating state, for example by pressurising a corresponding region on the outside of the mixing chamber circumferential wall such that the mixing chamber circumferential wall moves radially inwards into an operating position in which the at least one cavity is then present outside of the mixing chamber circumferential wall.

Thus, in operation of an inventive nozzle, the circumferential wall of the mixing chamber may not behave statically but constantly changes its shape on account of the deformations taking place into the at least one cavity. It is thereby prevented that deposits become stuck on the inside of the circumferential wall of the mixing chamber, and it is also achieved that deposits already adhering to the inside of the mixing chamber circumferential wall become detached again from the circumferential

wall in that they spall off the circumferential wall, so to speak. The occurrence of larger deposits disrupting the operation of the nozzle can thus be avoided as far as possible.

In preferred embodiments of the nozzle, the mixing chamber of an inventive nozzle has a circular cylindrical, tubular shape, so that the mixing chamber can then also be described as a mixing tube. Such a circular cylindrical configuration of the mixing chamber is not a necessary prerequisite for the functioning of an inventive nozzle, however, which is why mixing chambers that do not have a circular cylindrical shape can also be used.

The at least one cavity, which is in contact with the circumferential wall and at least substantially surrounds the mixing chamber in the circumferential direction, can extend over at least substantially the entire length of the mixing chamber. It can thereby be ensured that no disruptive deposits occur on the inside of the mixing chamber circumferential wall over the entire length of the mixing chamber.

In other embodiments, several axially successive cavities can be present seen over the length of the mixing chamber, which each at least substantially surround the mixing chamber in the circumferential direction. It is thereby possible, for example, to configure the circumferential wall of the mixing chamber in multiple parts, so that in the event of failure or excessive wear of the mixing chamber circumferential wall, only the affected portion of the circumferential wall needs to be exchanged in each case.

Regardless of whether only one cavity or several of these are present, advantageous embodiments of the inventive nozzle are characterised in that a pressure application device is present, which is connected to the at least one cavity in order, by applying pressure to the mixing chamber circumferential wall, to deform the latter into the mixing chamber. This deformation of the circumferential wall into the mixing chamber can go so far that the inside of the mixing chamber circumferential wall comes into contact with the mixing device, which rotates during operation of the nozzle, whereby the mixing device can scrape off any deposits adhering to the inside of the mixing chamber circumferential wall. At the same time, due to the contact of the rotating mixing device with the mixing chamber circumferential wall, deposits located on the mixing device also can be removed. In embodiments of the inventive nozzle that are provided with a pressure application device, it is therefore possible that the circumferential wall of the mixing chamber is deformed during operation both into the cavity and into the mixing chamber, wherein the latter is controlled by the pressure applied by the pressure application device. The effect achieved and desired may be amplified in this way. If several cavities are

present, not all cavities need to be connected to a pressure application device. On the contrary, it may suffice if those cavities surrounding regions of the mixing chamber that are particularly susceptible to internal soiling or the formation of deposits are connected to a pressure application device.

If desired, the cavity, some of the several cavities or all cavities can also be filled completely or partially with a material that does not disable the inventive function of the cavity or cavities. For example, an elastic foamed material can be contained in the cavity or in the cavities. In addition or alternatively to the aforesaid foamed material, a liquid, which can be used e.g. for heating or cooling the mixing chamber, can also be contained in the cavity or in the cavities. Care should then be taken, however, that such a liquid either does not fill the corresponding cavity completely or that the cavity is connected to an expansion vessel, as otherwise a desired deformation of the mixing chamber circumferential wall into the cavity would scarcely be possible any more.

According to one configuration, the mixing chamber is formed as an insert that can be inserted into the nozzle. Such an insert can consist of a suitable plastic material, for example. In the case of such an insert, the mixing chamber circumferential wall can be executed double-walled, so that the cavity, some of the several cavities or all cavities can be part of the insert in that it is or they are provided between a radially inner and a radially outer mixing chamber circumferential wall.

Preferred configurations of the inventive nozzle contain a flow cross-section reduction element, which is arranged centrally relative to the cross section of the mixing chamber in an end section of the mixing chamber comprising the outlet opening of the mixing chamber. In such configurations, one of the several cavities is further arranged such that it completely surrounds in the circumferential direction the region of the mixing chamber in which the flow cross-section reduction element is arranged. According to a development of such configurations, the portion of the circumferential wall associated with the cavity arranged in the region of the flow cross-section reduction element can be deformable by the application of pressure so far into the mixing chamber until the inside of the mixing chamber circumferential wall rests on the flow cross-section reduction element. In this way, an inventive nozzle can be shut off by quick and easy deformation of the corresponding portion of the mixing chamber circumferential wall and then reopened by relieving the pressure.