The invention concerns to a dosage-dispensing element (10) for free-flowing and pourable bulk materials, which has a main body that is deformable, in particular elastic, with a round inlet opening (11) and a slot-shaped outlet opening (21). On the opposite side from the inlet opening (11), the dosage-dispensing element has an oval surface area (20), in which the slot-shaped outlet (21) is oriented along the longitudinal axis of the oval surface (20). By applying lateral pressure on circumference points (12) in the area of the longitudinal axis of the oval surface (20), the outlet (21) can be opened to a variable width. The dosage-dispensing element (10) is preferably arranged as connecting sleeve in the shape of a truncated cone between containers and/or conduits, in particular between hoses.
DOSAGE-DISPENSING ELEMENT

[0001] The invention relates to a dosage-dispensing element with the features described in the introductory part of claim 1.

[0002] In the manufacture and use of free-flowing and pourable bulk materials, for example in agriculture, in the building materials industry or in the chemical industry, materials are often transferred from hoppers or large containers into smaller containers or are taken out in order to be used or sent to another location. To take out defined quantities, for example to weigh out equal quantities of a product, it is of particular importance to be able to control the flow of product out of the container as accurately as possible. In the handling of large quantities, the stream of material is often adjusted with simple slider gates, but this can often lead to an uncontrolled delivery of material during the opening or closing of the storage hopper. A dosage-dispensing device of this kind with a slider-controlled outlet opening is described for example in CH 681881 A5.

[0003] For an exactly measured delivery of small to extremely small product quantities, for example in laboratories, a dosage-dispensing device is described in CH 682994 A5 which resembles a baby pacifier through which pulverous or granular products are released by exerting lateral pressure on the dispensing device to open the outlet.

[0004] In the first-mentioned dosage-dispensing device, the way in which the out-flowing product quantity is controlled must be considered a drawback, which makes the device unsuitable for use in the dispensing of small and extremely small doses. The second of the aforementioned devices, on the other hand, is practically usable only for the delivery of the smallest quantities. This is due to the relatively small outlet opening, where the elastic main body of the device in the squeezed condition furthermore needs to be strongly deformed in relation to the dimensions of the dosage-dispensing device. However, the quantity of material passing through is still very small in relation to the overall area of the dosage-dispensing device. The formation of so-called material bridges, a problem which occurs in the hopper storage of pourable and free-flowing bulk materials, is solved in both devices through the use of agitators which have to be installed for this purpose in the area of or above the outlet opening.

[0005] It is therefore the object of the present invention to provide a dosage-dispensing element which is of a simple construction but allows a larger rate of material flow.

[0006] This task is solved by a dosage-dispensing element with the distinguishing features of claim 1. Further preferred embodiments of the invention are the subject of the dependent claims.

[0007] The present invention envisages a dosage-dispensing element for free-flowing and pourable bulk materials, which comprises a main body that is deformable, in particular elastic, with a round inlet opening and a slot-shaped outlet opening, wherein the latter can be opened up to a variable width by applying a lateral pressure. On the opposite side from the inlet opening, the dosage-dispensing element has a largely oval surface area (but the latter can also be circular in an extreme case). This surface area includes a slot-shaped outlet which is oriented in the direction of the longer main axis of the oval surface. The slot-shaped outlet preferably has a length that is greater than the internal diameter of the inlet opening. The purpose being achieved by this design is that after applying lateral pressure on the circumference of the oval surface area, the resultant aperture of the outlet slot will have a nearly equal surface area as the inlet opening, so that a pourable bulk material, for example a powder or granulate, can flow nearly unimpeded through the passage.

[0008] According to the preferred concept, to make the slot-shaped outlet wider, a compressive force is applied laterally to the dosage-dispensing element. The best result in opening the outlet is achieved if the compressive force is applied in the area of the circumference points of the longer main axis of the oval surface area. It is envisioned for this compressive force to be applied manually. However, it is also possible to use the dosage-dispensing element according to the invention in a remote-controllable system, wherein the control of the dosage-dispensing element is automated. For the control of the flow rate, all kinds of mechanical actuators can be considered, for example fluidic actuators or actuators made of a shape memory alloy.

[0009] Depending on the nature of the dosage-dispensing task, two different modes of operation are possible for the control of the outlet. If the task calls primarily for an uninterrupted delivery of product, it is possible to use the dosage-dispensing element with the slot-shaped outlet opening permanently spread apart, i.e. in the opened state. It is a sensible solution in this case to apply a compressive force, for example with clamps, in the vicinity of the aforementioned circumference points of the lengthwise axis of the oval surface area. These clamps can be released by means of a suitable fluidic actuator or pneumatic actuator if the product flow needs to be interrupted for example in the case of a malfunction or a change-over in production.

[0010] In a second mode of operation, the admixing or dispensing of the free-flowing or pourable materials from the supply hopper is only called for in certain phases of the production process, as for example in automatic feed dispensers. Accordingly, the slot-shaped outlet is held primarily in the non-compressed state, i.e. in the closed position. When needed, the compressive force can be applied through the activation of pressure elements which act at the same points as described for the first operating mode. For these pressure elements, one can use for example pneumatic clamping cylinders or parallel grippers. With the use of control elements, it is further possible in fully or partially automated systems to achieve a stepwise control of the compressive force that is being applied and thus of the flow-rate of the material that is being dispensed.

[0011] In order to assist in returning the distended outlet opening to the closed position, the preferred measure is to use an active resetting device which is for example spring-biased and reaches into the dosage-dispensing element or is incorporated in it. As an additional possibility, suitable resetting devices can be installed on or in the dosage-dispensing element, such as for example spiral springs or strips of a shape memory alloy that are incorporated or attached in a vulcanizing process. As another possibility, the circumference wall of the deformable main body can be configured as a pressure-inflatable hose, wherein the resetting of the distented outlet opening occurs by inflation of the hose with compressed air.

[0012] As the aperture area of the slot-shaped outlet in the dilated condition matches in essence the aperture area of the inlet opening, a virtually unhindered passage is achieved for the product that is to be dispensed. This obviates the need to use special actuators to prevent or break up material bridges.
Should conglomerations of material nevertheless occur in the area of the dosage-dispensing element, they can be removed by applying pressure manually, due to the deformable construction of the dosage-dispensing element.

In order to allow product to be dispensed in doses in a closed system, the dosage-dispensing element is configured as a sleeve coupling which connects two containers to each other. In this arrangement, the dosage-dispensing element is preferably shaped as a truncated cone whose diameter widens from the round inlet opening towards the oval area with the slot-shaped outlet opening, resembling a bell. It is especially preferred to connect hoses to each other in this way, as the dosage-dispensing element in this arrangement allows a particularly good control over the flow of material. The circumference wall of the dosage-dispensing element preferably includes seating features such as for example grooves around the circumference which are pushed over the rims of the containers and thus join the containers to the dosage-dispensing element. The connection is made in particular by pushing or pulling the circumference wall of the dosage-dispensing element over the rims of the containers. In addition, it is also conceivable to push the entire container, in particular hoses, over the dosage-dispensing element. A suitable hose can also be connected directly to the supply container with which the dosage-dispensing element is to used, whereby a closed system is formed. A more durable connection of containers such as for example reservoir hoppers and/or hoses to the dosage-dispensing element according to the invention can be produced in particular through vulcanizing or adhesive bonding.

It proves to be particularly advantageous to arrange the dosage-dispensing element in the interior of a hose which is used for example during the process of redistributing products from large containers into smaller containers. This hose, together with the dosage-dispensing element arranged inside it, can be durably connected to the larger container, and its free end can be inserted into the container that is to be filled. By applying a compressive force to the dosage-dispensing element and thereby spreading the slot-shaped outlet open, the product can be distributed into the smaller containers.

In the two aforementioned cases where the dosage-dispensing element is used with a hose, it is possible to close off or stop up the hose with clamps at the opposite end from the dosage-dispensing element. As a means to achieve the simplest possible hose shut-off, it is recommended to use magnetic particle strips at the extreme end of the hose. With these magnetic particle strips, one achieves that the hose closes almost automatically after the dispensing process. The aforementioned clamping-, stopping- and/or closing means which are arranged on a hose that is pushed over or welded to the dosage-dispensing element according to the invention have the additional advantage that when the hose is closed, substances which may cling to the inside of the hose and/or to the underside of the dosage-dispensing element and then fall off or run off and thereby contaminate the area around the dispensing or filling location are caught and held back in the closed-off hose.

The dosage-dispensing element is preferably made of a rubber- or silicone-based material. This allows a cost-effective production of the dosage-dispensing element out of one piece. Using an elastic material has the effect that after taking away the compression that was applied to open and spread the outlet opening, the dosage-dispensing element is returned to its initial condition even without using resetting devices, and the slot-shaped outlet stops the flow of the product being dispensed. As a means to produce especially durable dosage-dispensing elements, it suggests itself in particular to use textile-reinforced materials. Of course, as a means to stabilize the shape of the dosage-dispensing element and to help it return to its original shape after the element has been dilated, it is also possible to use a shape memory alloy for the aforementioned textile reinforcement in the dosage-dispensing element or for the additional elements that are vulcanized onto the finished workpiece.

Further advantages, features, and distinguishing characteristics of the invention are presented in the following description of preferred embodiments of the invention, without thereby implying any limitation. The description makes reference to the schematic illustrations which are not drawn to scale and wherein

FIG. 1a represents a plan view of a dosage-dispensing element in the non-compressed state;

FIG. 1b is a plan-view representation of the dosage-dispensing element of FIG. 1a with a compressive force being applied;

FIG. 2 represents a perspective view of the dosage-dispensing element according to the invention, and

FIG. 3 illustrates an example of an embodiment where the dosage-dispensing element is configured as a connecting sleeve between two containers that are arranged above one another.

FIG. 1 shows a dosage-dispensing element according to the invention in a plan-view drawing. Through what is here the upper, round inlet opening 11, a middle section of the outlet opening 21 can be seen which is partially covered up by the bell-tapered circumference wall 22 (see FIG. 2) of the dosage-dispensing element 10. The outlet opening 21 is aligned along the largest main axis of the elliptical or oval area 20. The slot-shaped outlet opening 21 in the embodiment shown in FIG. 1a is designed as a cut in the oval surface area 20, so that it divides nearly the entire oval area 20. The latter remains uncut only in the vicinity of the circumference.

As the dosage-dispensing element 10 in this first drawing is not yet being compressed at the circumference points 12 of the oval surface area 20, the oval shape of the surface area 20 of the dosage-dispensing element 10 on the opposite side from the inlet opening 11 becomes clearly evident. It is also obvious from this drawing that the outlet opening 21 is tightly closed, so that when the dosage-dispensing element 10 is used for example to dispense a pourable bulk material, the latter cannot flow out in this state of the outlet opening. In FIG. 1b the same dosage-dispensing element 10 is shown as in FIG. 1a, but the circumference points 12 of the longitudinal axis of the oval surface area 20 are in this case being pushed together by compressive forces as indicated by opposing arrows on both sides of the oval area 20.

FIG. 1b makes it evident that the compression at the circumference points 12 causes a deformation of the oval surface area 20 of the dosage-dispensing element 10, so that the latter takes on a round shape also at the underside, similar to the inlet opening 11. By exerting pressure on the circumference points 12, the slot-shaped outlet opening 21 is forced open at the same time as the oval area 20 is deformed into an approximately round area. As can be seen in FIG. 1b the slot-shaped outlet 21, in turn, is now taking on a nearly oval shape. Under the largest possible compression of the dosage-dispensing element 10, the area set free by the outlet 21 is
approximately equal to the area of the inlet opening 11. The material to be dispensed can thus pass nearly unhindered through the dosage-dispensing element 10. If the dosage-dispensing element 10 is used for example to dispense pourable building materials that have a tendency to form bridges, such formations are broken up by the fast flow of a large quantity of material or they can’t build up from the start. When using the dosage-dispensing element 10 according to the invention, the solution of installing special actuators for braking up the conglomerations, which is customary in conventional dosage-dispensing devices, is therefore in most cases unnecessary.

**FIG. 2** shows a perspective view of the dosage-dispensing element 10 according to the invention. This illustration shows that the circumference wall 22 of the dosage-dispensing element 10, which extends from the round inlet opening 11 to the oval area 20 with the slot-shaped outlet 21 has a tapered profile resembling the shape of a bell. The dosage-dispensing element 10 thus has the shape of a truncated cone with an elliptical or oval base.

**FIG. 3** shows an embodiment where the dosage-dispensing element 10 is used with two containers 31, 32. One of the containers in the example of FIG. 3 is a storage hopper 31 for pourable material. The dosage-dispensing element 10 is pushed over the outlet spout 33 and thereby releasably attached to the outlet spout. The second container, a hose 32, extends over the outside of the dosage-dispensing element 10, so that the oval area 20 and thus the slot-shaped outlet 21 is arranged inside the hose 32. The hose 32 is held in place by a clamping means 30, in this example a steel strap, on the outlet spout 33 of the storage hopper 31. By applying pressure to the circumference points 12, the outlet 21 of the dosage-dispensing element 10 can be spread open to a variable width, and the pourable material can in this way be dispensed. The flow rate of the material can be controlled by decreasing or increasing the compressive force on the circumference points 12. The entire dispensing process thus occurs inside a closed system, and any contamination of the surrounding space or of the dispensing station is now to the largest extent avoided. In addition, the hose 32 in the example of FIG. 3 comprises closure means 34 at the opposite end 35 of the hose in respect to the position of the dosage-dispensing element 10. The closure means in this example consists of magnetic particle strips, whereby a simple, fast and largely automatic and stable closure of the hose 32 is achieved, providing further protection from escaping contaminating substances which cling to the area around the slot-shaped outlet opening 21 of the dosage-dispensing element 10.

1. (canceled)

2. The element of claim 9, wherein the main body is a truncated cone.

3. The element of claim 2, wherein:
   the length of the slot-shaped outlet is larger than the internal diameter of the inlet opening.

4. The element of claim 3, wherein: the slot-shaped outlet can be opened to a variable width by applying lateral pressure in the area of circumference points on the major axis of the elliptical surface area.

5. The element of claim 9, wherein: the containers can be connected to a circumferential wall of the main body.

6. The element of claim 9, wherein: the element is arranged inside one of the containers, which is in the form of a hose.

7. The element of claim 9, wherein: the main body comprises a rubber- or silicone-based material.

8. The element of claim 9, wherein:
   the outlet comprises an active resetting device.

9. An element for dispensing dosages of a free-flowing and pourable bulk material between a pair of containers, comprising:
   a deformable main body having a round inlet opening and an elliptical surface opposite the inlet opening, the elliptical surface provided with a slot-shaped outlet opening oriented along a major axis thereof, a width of the outlet opening varying according to lateral pressure applied thereto;
   wherein the element is configured as a sleeve adapted for connecting the containers.

10. The element of claim 9, wherein:
    the length of the slot-shaped outlet is larger than the internal diameter of the inlet opening.

11. The element of claim 7, wherein:
    the rubber- or silicone-based material is reinforced with textile.

12. The element of claim 8, wherein:
    the active resetting device comprises a spring.

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