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54 **A DISCHARGE APPARATUS.**

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Description

The present invention relates to a discharge apparatus for a funnel-shaped container with an outlet at its narrow end, having a number of elements made of a gas-permeable material provided within the container on its wall so as to extend towards the outlet of the container in such a manner that a channel sealed along the edges of the elements is defined between each particular element and the wall of the container, the channel being divided into separate sections by means of transverse partition walls, and gas supply conduits being provided for these sections.

Bridging is a frequently occurring problem in the discharge of various materials from the lower end of funnel-shaped containers, which often form the lower end of a silo but can be open at the top as well. The bridging causes the discharge to be interrupted more or less temporarily.

A great variety of solutions have been suggested to eliminated bridging. A common feature of all these prior art solutions is that while they prevent permanent bridges and permanent discharge interruptions, the discharge is uneven. The container can be emptied at a relatively accurately defined average rate over a longer period of time; the discharge, however, takes place in relatively violent thrusts alternating with periods of less discharge or no discharge at all.

DE-A-1506977 discloses discharge apparatus which comprises a container with inclined side walls and an opening in its base. Porous elements are provided in the side walls. Air is supplied to the porous elements at a pressure selected according to the distribution of material in the container, to ensure that the distribution remains even.

The object of the invention is to provide an inexpensive discharge apparatus for powders, which allows a controllable and uninterrupted even discharge to be achieved, even with powders which are extremely liable to bridging.

Accordingly, the present invention provides an apparatus according to the introduction, in which apparatus each gas supply conduit is provided with a throttle provided by an apertured plate selected according to the material to be discharged from the container, the plate being capable of being removed from the conduit.

The elements made of a gas-permeable material are preferably arranged to extend at least substantially from the outlet of the funnel-shaped container up to the inlet end of the container.

Preferably, gas is supplied to all the channel sections from a common source. The gas supply conduits provided for each channel section is throttled by means of a throttle plate the throttle opening of which is chosen so as to suit the properties

of the active dry powder.

The gas-permeable elements are preferably made of a weldable sheet metal available on the market under the name DYNAPORE®, whereby the pores in the sheet metal are preferably directed obliquely downward and towards the outlet of the funnel-shaped container. Other materials for so called fluidised conveying can be used as well.

The throttled supply of gas into the separate channel sections between the wall of the container and the elements of gas-permeable material provides an uninterrupted even discharge of material, also when the material level in the funnel-shaped container is descending, right down to the outlet opening.

In the following, the invention will be described in more detail, with reference to a preferred embodiment shown in the attached drawing.

Figure 1 is a longitudinal sectional view of a funnel-shaped container with the apparatus according to the invention, the container forming a bottom at the lower end of a silo.

Figure 2 is a cross-sectional view through the upper end of the funnel-shaped silo bottom.

Figure 3 is an enlarged partial sectional view of the wall of the silo bottom at an element made of a material permeable to gas.

Figure 4 is an enlarged longitudinal sectional view of a gas supply conduit provided with a throttle.

Figure 5 is an enlarged partial longitudinal sectional view of the wall of the silo bottom and an element of gas-permeable material.

A funnel-shaped, preferably conical container forming the bottom at the lower end of a silo is designated generally by the reference numeral 1; the silo is designated by 17. The conical wall of the container 1 is designated by 2. An outlet 3 is provided at the lower end of the bottom part 1. A conventional pivotable valve plate (not shown in the drawing) can be provided in the outlet 3.

A number of elements 4 is mounted on the inside of the wall 2. The elements are made of a gas-permeable material, preferable of a sheet metal available on the market under the name DYNAPORE®, consisting of a porous metal sheet about 3 mm in thickness and welded up of a close-meshed metal network. Pores 7 in the sheet, Figure 5, are preferably directed obliquely downward towards the outlet 3 of the funnel.

The edges of the sheet elements 4 are welded to the wall 2, so that a channel 5 is defined between each sheet element 4 and the wall 2. Two such edge welds 6 are visible in Figure 3; in Figures 1 and 2, these welds are shown by means of dashes. The elements 4 extend from the upper end of the bottom part 1, which can be open at the top as well, down to the outlet 3. The channels 5

are divided into separate sections 9 by means of transverse partition walls 8. The sections are positioned one after another from the top towards the outlet 3. A separate gas supply conduit 10 is provided for each channel section 9, the gas being mostly air or nitrogen, for instance. Each supply conduit 10 comprises a throttle 11. As appears from Figure 4, the throttle 11 can be formed by means of a throttle plate with a constant throttle opening suited for the properties of the material. 12 designates a rubber hose and 13 a hose clamp. The throttle plate is replaced whenever required.

The supply of gas is preferably carried out from a common source the outlet conduit of which is designated with 14. 15 designates the extension of the conduit 14 along the wall of the bottom part 1, and 16 designates annular distribution conduits extending around the bottom part 1 up to each particular channel section 9.

Gas trickling out through the elements 4 activates the material in the bottom part 1 so that an uninterrupted even flow is obtained through the outlet 3. As the channels 5 are divided into the separate transverse sections 9 and the supply of gas into each section 9 is throttled, the discharge of the material takes place evenly even when the material level in the bottom part 1 is descending. In spite of the fact that the uppermost portions of the elements become uncovered so that the flow resistance is decreased, the throttles 11 prevent the gas from "escaping" through the uncovered element portions.

The combination of the throttled supply of gas and the provision of the separate channel sections also keeps the consumption of gas at a low level, which is an advantage not only economically but also for the reason that high consumption of gas involves filtering problems with the excess gas to avoid formation of dust.

From the technical point of view, it would be preferable to coat the entire inside of the bottom part 1 with a gas-permeable material; this, however, would be unreasonably expensive. A fully satisfactory result is achieved by coating only part of the inside the funnel wall, e.g. with four elements as shown in the drawing. The desired result is also achieved with three elements only, especially if they are slightly wider. If a greater number of elements 4 is used, the individual elements can, of course, be narrower.

Full-scale experiments have been performed on the apparatus with dry fibre-containing powders. Previously, a satisfactory discharge of fibre-containing materials has not been possible with methods used for the purpose. The silo used in the experiment was provided with a closing device resembling a throttle valve in the outlet of the funnel-shaped bottom part. When the closing de-

vice was opened wide open, the valve plate dug a hole in the dry powder positioned above it without that the powder began to flow out of the silo. But when the supply of gas according to the invention was initiated, the material began to flow out, and the flow continued uninterruptedly and homogeneously as long as gas was being supplied. When the supply of gas was interrupted, the flow ended. At a low material level in the silo, that is, when the silo was nearly empty, no gas flow causing dust problems occurred from the uncovered portion of the silo bottom, when the throttling according to the invention was suitably chosen in view of the properties of the material. No dust filter was required.

Claims

1. A discharge apparatus for a funnel-shaped container with an outlet at its narrow end, having a number of elements (4) made of a gas-permeable material provided within the container (1) on its wall (2) so as to extend towards the outlet (3) of the container in such a manner that a channel (5) sealed along the edges of the elements is defined between each particular element (4) and the wall (2) of the container (1), the channel (5) being divided into separate sections (9) by means of transverse partition walls (8), and gas supply conduits (10) being provided for these sections, characterised in that each gas supply conduit (10) is provided with a throttle (11) provided by an apertured plate selected according to the material to be discharged from the container, the plate being capable of being removed from the conduit.
2. A discharge apparatus according to claim 1, in which a slit is formed in the conduit (10) for receiving the apertured plate (11), the apparatus including a sealing member (12, 13) to be positioned around the slit and adjacent portions of the conduit (10).
3. A discharge apparatus as claimed in claim 2, in which the sealing member (12, 13) is sleeve-like.

Patentansprüche

1. Entladevorrichtung für einen trichterförmigen Behälter mit einem Auslaß an seinem engen Ende, mit einer Zahl von in dem Behälter (1) an seiner Wand (2) derart vorgesehenen, aus gasdurchlässigem Material hergestellten Elementen (4), daß sie sich in Richtung auf den Auslaß (3) des Behälters in einer solchen Weise erstrecken, daß ein längs der Kanten des

Elements abgedichteter Kanal (5) zwischen jedem einzelnen Element (4) und der Wand (2) des Behälters (1) gebildet wird, wobei der Kanal (5) in getrennte Abschnitte (9) mit Hilfe von Querunterteilungswänden (8) unterteilt ist und Gasversorgungsleitungen (10) für diese Abschnitte vorgesehen sind, dadurch gekennzeichnet, daß jede Gasversorgungsleitung (10) mit einer Drossel (11) versehen ist, die von einer nach dem aus dem Behälter abzugebenden Material ausgewählten, mit einer Öffnung versehenen Platte vorgesehen ist, die aus der Leitung entfernt werden kann.

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2. Entladevorrichtung nach Anspruch 1, bei der ein Schlitz in der Leitung (10) zur Aufnahme der mit der Öffnung versehenen Platte (11) gebildet ist, wobei die Vorrichtung ein Dichtelement (12, 13) zur Positionierung um den Schlitz und benachbarte Abschnitte der Leitung (10) enthält.
3. Entladevorrichtung nach Anspruch 2, bei dem das Dichtelement (12, 13) hülsenartig ist.

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Revendications

1. Appareil de déchargement pour un récipient en forme d'entonnoir présentant une sortie à son extrémité étroite, équipé d'un certain nombre d'éléments (4) faits d'une matière perméable aux gaz prévus dans le récipient (1) sur sa paroi (2) de manière à s'étendre vers la sortie (3) du récipient de manière qu'un canal (5) fermé le long des bords des éléments soit défini entre chaque élément particulier (4) et la paroi (2) du récipient (1), le canal (5) étant divisé en sections séparées (9) au moyen de cloisons transversales (8), et des conduits d'alimentation en gaz (10) étant prévus pour ces sections, caractérisé en ce que chaque conduit (10) d'alimentation en gaz est muni d'un étranglement (11) formé par une plaque perforée sélectionnée en fonction d'une matière qu'il s'agit de décharger du récipient, la plaque pouvant être retirée du conduit,
2. Appareil de déchargement selon la revendication 1, dans lequel une fente est formée dans le conduit (10) pour recevoir la plaque perforée (11), l'appareil comprenant un élément d'étanchéité (12, 13) qui doit être positionné autour de la fente et des parties adjacentes du conduit (10).
3. Appareil de déchargement selon la revendication 2, dans lequel l'élément d'étanchéité (12, 13) est en forme de manchon.

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