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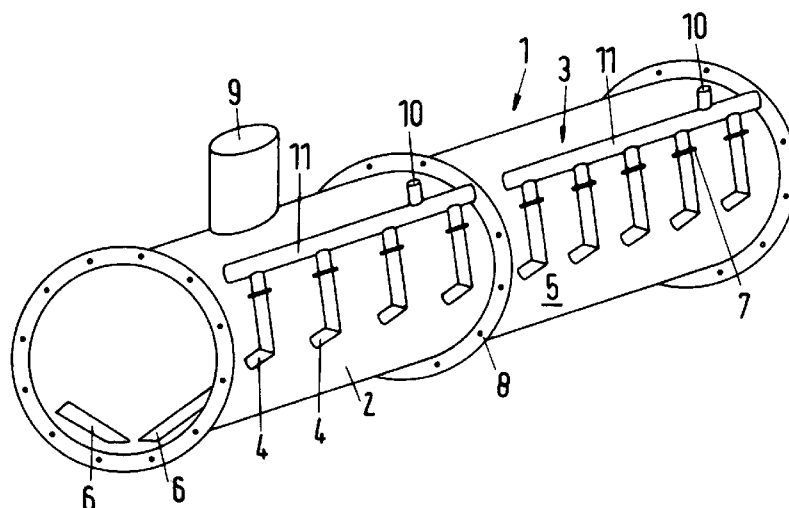
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(54) Title: DEVICE FOR TRANSPORTING BULK MATERIALS



(57) Abstract: A device for transporting bulk materials comprises a conveying chute (1) having at least one tubular conveying chute portion (2), in which fluidizing gas can be introduced into the lower region of the tube cross-section via at least one main channel (3) or main channel portion (11) extending in longitudinal direction of the conveying chute (1) and via gas outlet channels (4) branching off from the same at intervals. The at least one main channel (3) or main channel portion (11) extends outside the conveying chute (1) or the respective conveying chute portion (2). At least at their gas outlet end, the gas outlet channels (4) are formed as nozzle tubes (6) branching off from the main channel (3) or the respective main channel portion (11) and directed downwards at an angle from the side through the tube wall (5) of the conveying chute (1) or the respective conveying chute portion (2).



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Device for Transporting Bulk Materials

This invention relates to a device for transporting bulk materials, with a conveying chute having at least one tubular conveying chute portion, in which fluidizing gas can be introduced into the lower region of the tube cross-section via at least one main channel or main channel portion extending in longitudinal direction of the conveying chute or conveying chute portion and via gas outlet channels branching off from the same at intervals.

Such devices for example serve for pneumatically transporting powdery bulk materials, such as dry aluminium hydrate, from an electrostatic precipitator to an airlift inside a calcining plant or for transporting alumina to a silo. Such devices can, however, also be used for transporting any other bulk material.

Classical fluidizing conveying chutes are characterized for example by an inclined rectangular housing channel which in its lower region is provided with a fluidizing base. When the bulk material is fluidized via the fluidizing base, it behaves like a liquid and flows in the direction of the slope. The fluidizing base generally consists of a porous material in the form of a fine cloth or a more stable sintered metal membrane through which the fluidizing gas can flow, but the solids cannot fall through the same. The cloth, however, can easily tear, wear and clog in the course of time. Sintered metal membranes often are obstructed in the course of time by extremely fine particles accumulating in the pores of the sintered metal. Both render it necessary to regularly replace the fluidizing base. In the case of moist bulk material, the same can even block immediately by "cementing", which requires a replacement of the fluidizing base. When introducing sharp-edged objects into the stream of bulk material, e.g. during maintenance work, the fluidizing base can also be damaged. Therefore, a grid is required at the bulk material inlet of conventional fluidizing conveying chutes. When objects are accumulated on the grid, the same must be cleaned from time to time. A further disadvantage of conventional fluidizing conveying chutes with rectangular housing channel consists in the risk of leakages of the flange connections extending in longitudinal direction of the channel.

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From DE 197 09 425 C1 a device for fluidizing and transporting fine-grained, powdery or short-fibered materials inside a hose, tube or container is known, to which fluidizing gas is supplied via a main channel extending in longitudinal direction of the hose, tube or container and a plurality of throttle connecting channels arranged in series. The main channel and the throttle channels are arranged inside a gas distribution profile element provided on the inside of the hose, tube or container wall and via intermediate chambers are connected with the interior of the hose, tube or container via a multitude of gas outlet channels arranged one beside the other in the gas distribution profile element in longitudinal direction. In this way, only part of the above described disadvantages are eliminated. In addition, the problem exists that the throttle connecting channels, intermediate chambers and gas outlet channels arranged inside the hose, tube or container are hardly accessible in the case of maintenance and e.g. neither permit a regulation of the fluidizing gas along the length of the conveying chutes.

Similar disadvantages exist in a device for pneumatically conveying bulk materials in a dense flow, which is known from EP 1 623 941 A1. This device for pneumatically conveying a flowable material in a dense flow includes a conveying conduit of closed cross-section with a conveying channel, a compressed gas secondary conduit with a compressed gas channel and compressed gas transmitting means for feeding the conveying channel with a compressed gas from the compressed gas channel. To the conveying channel a fluidizing means is associated, which includes a fluidizing channel with fluidizing gas transmitting means for feeding a fluidizing gas from the fluidizing gas channel into the conveying channel. The fluidizing body and the tubular fluidizing gas channel likewise are accommodated inside the conveying conduit of closed cross-section with the same problem of a lack of accessibility for maintenance and/or repair work.

It is the object of the present invention to create a device for transporting bulk materials, in which the above-described disadvantages do not occur and in particular an easy accessibility and controllability of the fluidizing means is provided.

For the solution of this object, it is in particular provided in a transporting device in accordance with the invention with the features of claim 1 that the at least one main

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channel or main channel portion extends outside the conveying chute or the respective conveying chute portion, and at least at their gas outlet ends the gas outlet channels are formed as nozzle tubes branching off from the main channel or the respective main channel portion and directed downwards at an angle from the side through the tube wall of the conveying chute or the respective conveying chute portion.

Thus, the conveying chute for example is composed of conventional round tube portions which can be connected by means of usual end-face flange connections. Leakages at flange connections extending along the entire length of the conveying chute thereby are prevented. For fluidization, tube nozzles can be used, which are introduced into the conveying chute obliquely from the side, wherein their gas outlet ends are directed downwards at an angle, so that solids which have entered can easily flow out of the same. The fluidizing nozzles are supplied with air via a main channel, preferably one on each side per conveying chute portion. To achieve a uniform distribution of the air in the conveying chute, the fluidizing nozzles can e.g. independently be provided with adjustable flow resistors. Due to the round cross-section, the amount of fluidizing gas is smaller in the tubular conveying chute than in a rectangular conveying chute. Since the conveying chute largely is closed, it is also suitable for operation at positive pressure. Since a fluidizing base no longer is required, the invented transporting device is insensitive to mechanical influences, so that a grid can be omitted at the bulk material inlet. There is no sensitivity to moisture either. Furthermore, an essential advantage in particular consists in that the entire fluidizing gas supply system is easily accessible, so that an easy accessibility for maintenance and repair work is ensured in the case of malfunctions such as clogging of the nozzles. Cleaning by means of water also is easily possible.

In the sub-claims, particular features of the novel transporting device are identified in detail.

In a particular aspect of the invention, at least one separate main channel portion is associated to each conveying chute portion, which can separately be supplied with fluidizing gas.

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If two main channels or main channel portions are symmetrical to the vertical longitudinal median plane of the conveying chute or conveying chute portion in the upper region thereof, a uniform supply of fluidizing gas can be achieved in a simple way.

- 5 By means of the flow resistors, undesired non-uniformities of the supply of fluidizing gas into the conveying chute can be compensated.

For simplicity and for space saving reasons, the at least one main channel or the at least one main channel portions can be attached to the outside of the tube wall of the
10 conveying chute.

In practical operation, the positioning of the nozzle tubes is provided for example at intervals of about 100 to 400 mm, preferably about 150 to 250 mm.

- 15 For properly conveying the bulk material, an inclination of the conveying chute or conveying chute portions can be utilized. The inclination of the conveying chute for example is about 1 to 20°, preferably about 5 to 15°.

To be able to use the conveying chute also for bulk material with an elevated temperature of up to 1200 °C, it preferably is supported by a steel structure and/or a brick
20 lining.

For assembly, adjoining conveying chute portions are sealingly connected with each other via end-face flanges.

25

Due to the good accessibilities of the gas fluidizing system, the nozzle tubes also can be provided for example with cleaning and/or poking holes accessible from outside the conveying chute.

- 30 Further developments, advantages and possible applications can be taken from the following description of an embodiment and the drawing. All features described and/or illustrated form the subject-matter of the invention per se or in any combination, independent of their inclusion in individual claims or their back-reference.

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The only Figure illustrates a part of a transporting device including the invention in an oblique view.

5 The device for transporting bulk materials, which is schematically shown in the drawing, includes a conveying chute 1 which is formed of individual tubular conveying chute portions 2. To each conveying chute portion 2 a main channel portion 11 of a main channel 3 with fluidizing gas supply ports 10 is associated, and preferably two such main channel portions 11 each in the upper region of the respective conveying chute
10 portion 2 symmetrical to the vertical longitudinal median plane of the conveying chute 1. Only the front main channel portion 11 each is shown in the drawing. The one conveying chute portion 2 is represented with a bulk material supply port 9. Gas outlet channels 4 branch off at intervals from the main channel 3 or the respective main channel portions 11, through which fluidizing gas can be introduced into the lower
15 region of the tube cross-section.

The main channel 3 extends or the main channel portions 11 each extend outside the conveying chute 1 or the respective conveying chute portion 2, on which the respective main channel 3 or the respective main channel portions 11 can be mounted. In any
20 case, the gas outlet channels 4 each constitute nozzle tubes 6 directed downwards at an angle from the side through the tube wall 5 at their gas inlet end in the lower region of the conveying chute 1.

The individual gas outlet channels 4 can be provided with preferably individually adjustable flow resistors 7.
25

The positioning of the nozzle tubes 6 is provided for example at intervals of about 100 to 400 mm, preferably about 150 to 250 mm.

30 Cleaning and/or poking holes at the nozzle tubes 6 are not shown in the drawing.

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List of reference numerals:

	1	conveying chute
5	2	conveying chute portions
	3	main channel
	4	gas outlet channels
	5	tube wall
	6	nozzle tubes
10	7	flow resistors
	8	flanges
	9	bulk material supply port
	10	fluidizing gas supply port
	11	main channel portions
15		

Claims:

1. A device for transporting bulk materials, with a conveying chute (1) having at least one tubular conveying chute portion (2), in which fluidizing gas can be introduced into the lower region of the tube cross-section via at least one main channel (3) or main channel portion (11) extending in longitudinal direction of the conveying chute (1) and via gas outlet channels (4) branching off from the same at intervals, **characterized in** that the at least one main channel (3) or main channel portion (11) extends outside the conveying chute (1) or the respective conveying chute portion (2) and at least at their gas outlet ends the gas outlet channels (4) are formed as nozzle tubes (6) branching off from the main channel (3) or the respective main channel portion (11) and directed downwards at an angle from the side through the tube wall (5) of the conveying chute (1) or the respective conveying chute portion (2).
2. The device according to claim 1, **characterized in** that to each conveying chute portion (2) a separate main channel portion (11) is associated, which can separately be supplied with fluidizing gas.
3. The device according to claim 1 or 2, **characterized in** that two main channels (3) or main channel portions (11) are arranged symmetrical to the vertical longitudinal median plane of the conveying chute (1) in the upper region of the conveying chute (1).
4. The device according to any one of the preceding claims, **characterized in** that the gas outlet channels (4) are provided with flow resistors (7) preferably arranged outside the conveying chute (1), which in particular are adjustable.
5. The device according to any one of the preceding claims, **characterized in** that the at least one main channel (3) or main channel portion (11) is attached to the outside of the tube wall (5) of the conveying chute (1).

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6. The device according to any one of the preceding claims, **characterized in** that the nozzle tubes (6) are positioned at intervals of about 100 to 400 mm, preferably about 150 to 250 mm.

5 7. The device according to any one of the preceding claims, **characterized in** that the conveying chute (1) or the conveying chute portions (2) is/are inclined.

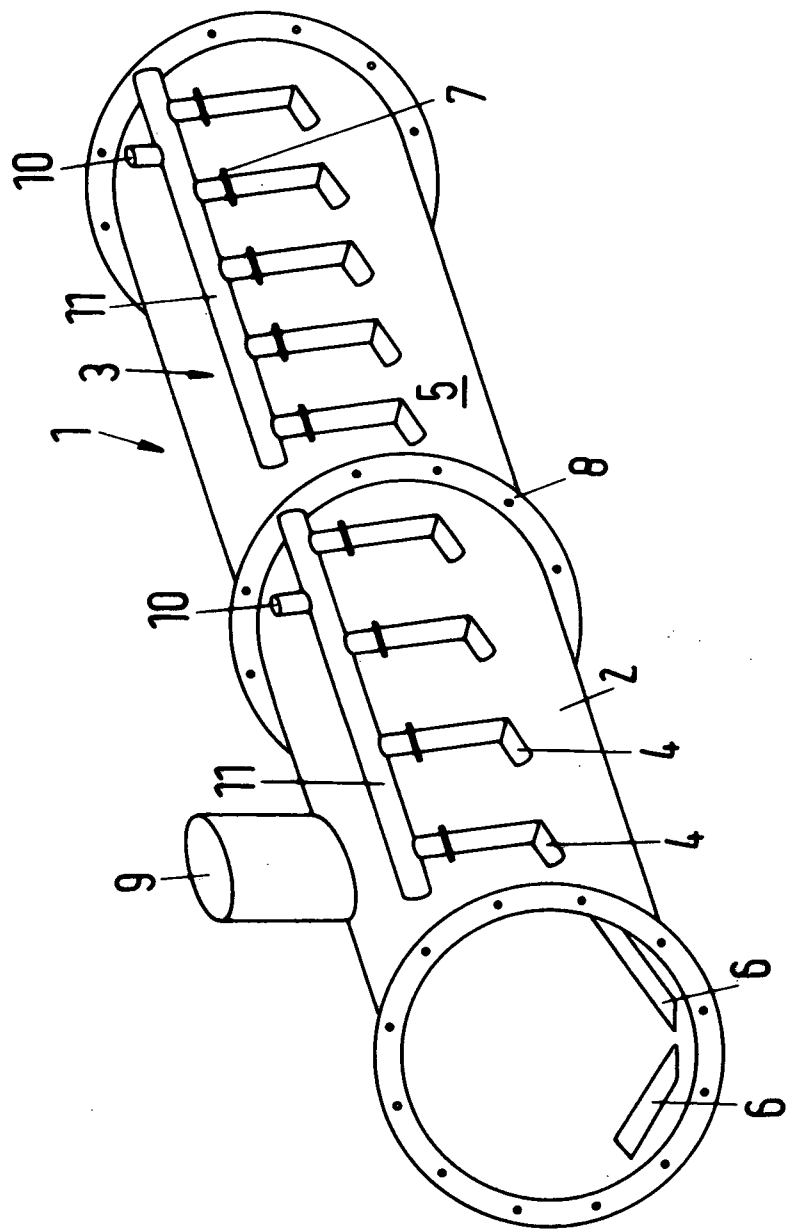
8. The device according to claim 7, **characterized in** that the inclination of the conveying chute (1) or the conveying chute portions (2) is about 1 to 20°, preferably
10 about 5 to 15°.

9. The device according to any one of the preceding claims, **characterized in** that the conveying chute (1) or the conveying chute portions (2) is/are supported by a steel structure and/or a brick lining.
15

10. The device according to any one of the preceding claims, **characterized in** that at least two conveying chute portions (2) are sealingly connected with each other via end-face flanges (8).

20 11. The device according to any one of the preceding claims, **characterized in** that the nozzle tubes (6) are provided with cleaning and/or poking holes accessible from outside the conveying chute (1).

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INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER

INV. B65G53/16 B65G53/52

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	page 2, line 56 - line 105; figures -----	2,4,10
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Y	EP 0 043 117 A1 (DÜRR AUTOMATION+FÖRDERTECHNIK) 6 January 1982 (1982-01-06) page 7, line 4 - page 8, line 27; claims; figures -----	2,4
Y	US 2004/037658 A1 (J. PFEIFFER) 26 February 2004 (2004-02-26) page 1, column 2, line 20 - page 2, column 1, line 29; figures -----	10
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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International application No

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