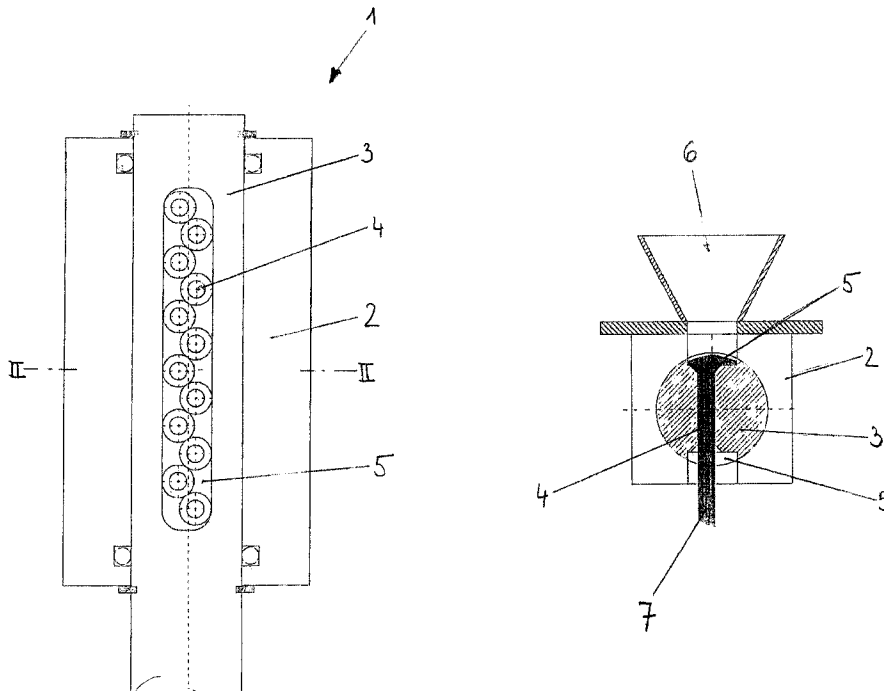




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(54) Titre : MODULE D'APPROVISIONNEMENT DE PRODUITS PATEUX SUR UNE COURROIE
(54) Title: UNIT FOR FEEDING PASTY PRODUCTS ONTO A BELT



(57) Abrégé/Abstract:

The invention relates to a device for feeding pasty products onto a belt and which has a shaping device, where a die with bore holes and channels is provided. It is mainly characterised in that the die in the form of a shaft is provided with radial channels and is located in a housing with a feed opening for the product and outflow openings for the extruded material. The flow direction can be reversed by rotating the shaft, and the channels are thus cleaned.

Abstract

The invention relates to a device for feeding pasty products onto a belt and which has a shaping device, where a die with bore holes and channels is provided. It is mainly characterised in that the die in the form of a shaft is provided with radial channels and is located in a housing with a feed opening for the product and outflow openings for the extruded material. The flow direction can be reversed by rotating the shaft, and the channels are thus cleaned.

Unit for feeding pasty products onto a belt

The invention relates to a device for feeding pasty products onto a belt and with a shaping device, where a die with bore holes and channels is provided and the die in the form of a shaft is provided with radial channels and is located in a housing with a feed opening for the product and outflow openings for the extruded material. It also relates to a plant with a feed unit.

In convective drying of pasty products, it is essential to use granulation to create enough surface area for the mass and heat transfer. In most convective dryers, such as fluidized bed equipment, drum dryers, and flash tube dryers, this alone is adequate. In belt dryers, an additional requirement must be met. On these belts, the granulated product rests on a conveyor belt that is permeable to gas and on which it is conveyed straight through a current of hot gas. In order to ensure efficient, even drying, the product must not only be granulated, but also applied evenly with a constant layer thickness to the belt with gas flowing through it so that a homogeneous, porous layer is obtained through which the drying gas can flow evenly.

These requirements are met in different ways. A common method is to granulate the materials by means of agglomeration in a mixer or granulating device. In this process, the pasty product is blended with the recycled dry product in the correct proportions and attains a crumbly structure when mechanical energy is applied. At the belt dryer, the free-flowing granulate is applied to the belt by screw conveyors, scrapers, and similar, maintaining a constant layer height. The disadvantage of this process is the increased amount of equipment and control instrumentation required. Additional conveying elements, granulating equipment and distribution devices are needed, and precise dosing of moist and dry product must be ensured because there is only a narrow moisture content range for mixing in which granulation provides satisfactory results.

Alternative processes break down the moist, pasty product by means of rotating tools such as milling cutter-like rolls, impellers and pin wheels, cage wheels, rotary chopper wheels, or similar devices. However, these have failed to establish themselves in belt dryers.

A third important process is the extrusion of pasty products through a die with several holes that divide the product into thinner strands. The product must be suitable for pumping so that it can flow through the holes in the die. For this purpose, pressure must be built up ahead of the die, and this can be achieved in many different ways. Upstream displacement pumps, such as piston pumps, helical rotor pumps, twin-shaft screw conveyors, etc., lend themselves to

such tasks and allow the conveying and shaping sections to be separated in terms of space. In addition, integrated devices have established their presence, such as edge mills, where a roll pair runs on the perforated die and the pressure is built up in the roll gap. What these processes have in common is that the spatial expansion of the die is only a few decimetres.

5 Hence, the die must run over the considerably larger belt width (up to several meters) in order to achieve even feeding if it is to be used in a belt dryer.

DE 3518323 A1 describes a device that avoids this disadvantage by giving the die an oblong shape extending over the entire width of the belt in the base of a box. The pressure is generated by a flap valve that pivots back and forth in the box, covers one half of the die and has a rotational axis that is centred in the longitudinal direction of the die. The material is fed
10 in through a feed unit mounted up above, also extending over the entire length.

One variant of this principle is found in the so-called pivoting press manufactured by EL-A Verfahrenstechnik GmbH, where the flap valve is replaced by a cylinder with two longitudinal sealing strips. The cylinder oscillates in a trough with a semi-circular, dished
15 base, which also has a sealing strip at its lowest point. The perforated die runs to the left and right of this strip in a narrow sector, but over the entire length. Due to the oscillating movement, the areas formed by the three strips are filled alternately with pasty product and emptied again through the holes in the die.

What all die processes have in common, however, is the blinding tendency of the holes
20 measuring only a few millimetres, caused by foreign objects, particularly fibres, such as hair, which occurs in larger quantities in sewage sludge in particular. DE 3518323 A1 describes how a suction effect that displaces the fibres slightly and should push them out during the next pressing cycle is to be created by special adjustment of the rotation angle speed of the press flap valve. However, hair especially tends to become trapped over two holes because of
25 its considerable length compared to the dimensions of the hole and this cannot be prevented by only slight displacement. US 2487910 shows an extruding device intended for production of plastic parts in strand form. As only pure products are used here, blinding is not an issue. DE 10 2013 025 259 also shows a device for continuous casting of thermoplastics.

US 5921001 shows a plant for drying or cooling a product that is fed onto a belt by means of
30 an oscillating chute.

The object of the invention is to create a device for the die process in which the blinding tendency is eliminated.

The invention is thus characterized in that the shaft has grooves into which the feed and outflow holes of the channels discharge. Due to the die having the form of a shaft, the flow direction can be reversed by rotating it, resulting in the channels being cleaned and the contaminants removed more easily from the grooves.

- 5 An advantageous further development of the invention is characterised in that the shaft has at least one or preferably two rows of channels, where each row of channels comprises between 4 and 10, for example six, channels. As a result, the shaft can be adapted particularly well to the desired throughput.

A favourable embodiment of the invention is thus characterised in that the diameter of the
10 channels is between 2 and 30 mm, preferably between 5 and 10 mm. As a result, the shaft can be adapted particularly well to the characteristics of the product.

A favourable further development of the invention is thus characterised in that the shaft is provided with a drive that makes it possible to rotate the shaft in order to reverse the direction of flow. In this way, a cleaning cycle can be implemented automatically, where the flow
15 direction can be reversed as well in the event of a sudden blockage, enabling a cleaning cycle to be initiated immediately.

The invention also relates to a plant with a feeding device that is characterised in that a feed screw is provided with the feed unit arranged at its outlet end, where a continuously revolving belt can be provided above which the feed unit is arranged. In this way, the necessary pressing
20 force can be applied continuously by the screw conveyor and the extruded material carried off continuously by the belt. The belt can be made preferably of textile or metal mesh, perforated segments, or trays arranged next to one another and with a base that is permeable to gas.

A favourable embodiment of the invention is thus characterised in that the belt is the drying belt of a belt dryer. The feed unit according to the invention can be used advantageously,
25 especially in belt dryers, in order to distribute the product to be dried as evenly as possible.

An advantageous embodiment of the invention is characterised in that the discharge device has a pivoting arrangement, or where the discharge device can be moved in linear direction as an alternative.

A favourable further development of the invention is characterised in that the discharge
30 device is mounted at right angles to the conveying direction of the belt and extends over the entire belt width as well as over one or several rows of the channels in the die. The number of

channels in each row here is selected such as to provide even distribution of the extruded material over the width of the belt.

5 The reduced blinding tendency is largely achieved by reversing the flow direction in the die regularly without interrupting the dosing process so that any blinding of individual holes or channels beginning on the discharge side can be discharged easily in the direction of the belt when the flow direction has been reversed. This guarantees continuous operation with interruption and consistent product distribution quality without regular or unexpected interruptions for cleaning.

10

According to an aspect of the present invention, there is provided a feed unit for feeding pasty products, comprising a shaping device, where a die with bore holes and channels is provided through which the product can flow, where the die is provided in the form of a shaft with continuous radial channels and is located in a housing with feed opening for the product and 15 outflow opening for the extruded material, where the channels have feed and outflow openings, wherein the shaft has grooves into which the feed and outflow openings of the channels open.

The invention will now be described in examples and referring to the drawings, where Fig. 1 shows a longitudinal section through a discharge device according to the invention, 20 Fig. 2 shows a cross-section through a discharge device according to the invention, Fig. 3 shows a view of a plant according to the invention, and Fig. 4 shows a top view of a plant according to the invention.

Fig. 1 shows a longitudinal section of a discharge device 1 according to the invention. This has a 25 housing 2 in which a shaft 3 is arranged, which serves as a die. It is made with one or several radial rows of channels, designed here as two rows of cylindrical bore holes 4 or channels. Each row contains six bore holes in this example, where 4 to 10 channels/bore holes, are typical, however there can also be significantly more or less channels depending on the dosage capacity. The hydraulic diameter of the channels depends on the rheological properties of the pasty product 30 and lies between 2 and 30 mm, typically between 5 and 10 mm.

The shaft 3 is levelled off or dished longitudinally at the circumference, e.g. with a groove 5, above the row of bore holes. This not only makes drilling easier, but serves primarily to carry along foreign objects during the rotation described below. The required pressing force can be
5 influenced by the length and shape of the bore hole.

The shaft 3 runs typically in the housing 2 through which the pasty product, e.g. sewage sludge, is fed in. The die shaft 3 is rotated at periodic intervals, depending on the blinding tendency, so that the flow direction in the channels 4 reverses and any foreign objects in front of the former inlet
10 hole are pressed out. In this way, fibres and hair with the ends stuck in two different channels are also removed.

Figure 2 shows a cross-section through the feed unit according to the invention along the line marked II-II in Fig. 1. The pasty product is pressed from above through a feed opening 6 into the housing 2 by a suitable conveying device and leaves it again through the shaping channels 4 as multiple strands 7, which land on the belt and then enter the dryer.

5 Figure 3 shows a plant with a feed unit 1 according to the invention in combination with a two-stage belt dryer. The feed unit 1 according to the invention is mounted here at a screw pump 8 outlet. The pasty product 9 is fed to the screw pump 8 via a storage tank 10 and through the unit 1 in strands 7 to the drying belt 11 of the first stage. The feed unit 1 is arranged here on a pivoting drive 12 together with the screw pump 8. The entire width of the
10 belt 11 is covered evenly due to the controlled pivoting movement. In order to achieve this, the pivoting speed must be aligned with the belt speed, the output, and the selected geometry of the shaft. As an alternative, the feed unit can also be mounted in a linear arrangement such that it can be moved at right angles to the belt running direction.

The shaft 3 of the feed unit 1 is provided with a drive 13. In the housing 2 of the device 1, the
15 die shaft 3 is rotated by the drive 13 when necessary until the conveying direction through the channels 4 is reversed.

Figure 4 shows a top view of the plant according to Fig. 3, where the pivoting angle of the screw pump 8 with feed unit 1 and the area in which the product strand 7 is deposited can be identified easily.

20 The invention is not limited to the examples shown. In fact, the discharge unit can be designed such that it is movable if necessary or extends over the entire belt width.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A feed unit for feeding pasty products, comprising a shaping device, where a die with bore holes and channels is provided through which the product can flow, where the die is provided in the form of a shaft with continuous radial channels and is located in a housing with feed opening for the product and outflow opening for the extruded material, where the channels have feed and outflow openings, wherein the shaft has grooves into which the feed and outflow openings of the channels open.
2. The feed unit according to claim 1, wherein the shaft has at least one or preferably two rows of channels.
3. The feed unit according to claim 1 or 2, wherein the diameter of the channels is between 2 and 30 mm.
4. The feed unit according to claim 3, wherein the diameter of the channels is between 5 and 10 mm.
5. The feed unit according to any one of claims 1 to 4, wherein the shaft is provided with a drive that makes it possible to rotate the shaft in order to reverse the direction of flow.
6. The feed unit according to any one of claims 1 to 5, wherein each row of channels comprises between 4 and 10 channels.
7. The feed unit according to claim 6, wherein each row of channels comprises six channels.
8. A plant with a feed unit as defined by any one of claims 1 to 7, wherein a feed screw is provided with the feed unit arranged at its outlet end.
9. The plant according to claim 8, wherein the feed screw is a screw pump.

10. The plant according to claim 8 or 9, wherein a continuously revolving belt is provided above which the feed unit is arranged.
11. The plant according to any one of claims 8 to 10, wherein the belt is the drying belt of a belt dryer.
12. The plant according to any one of claims 8 to 11, wherein the discharge device has a pivoting arrangement.
13. The plant according to any one of claims 8 to 12, wherein the discharge device can be moved in linear direction.
14. The plant according to any one of claims 8 to 13, wherein the discharge device extends at right angles across the entire belt width.

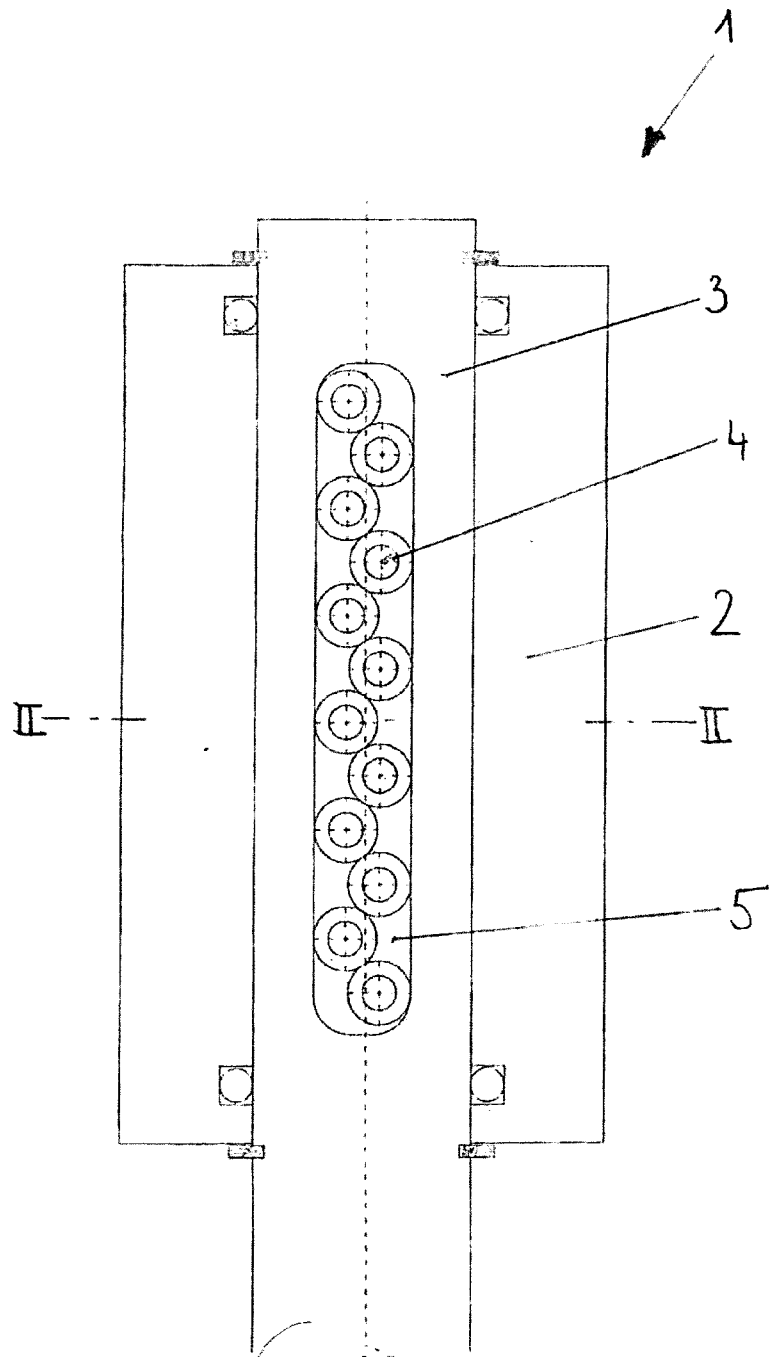


Fig.1

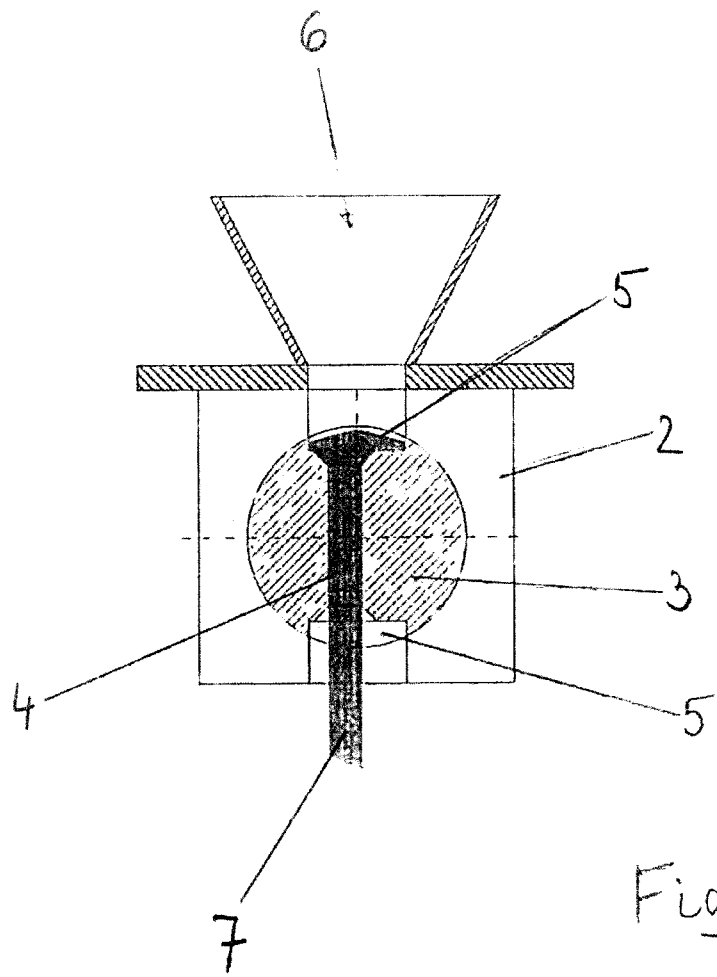
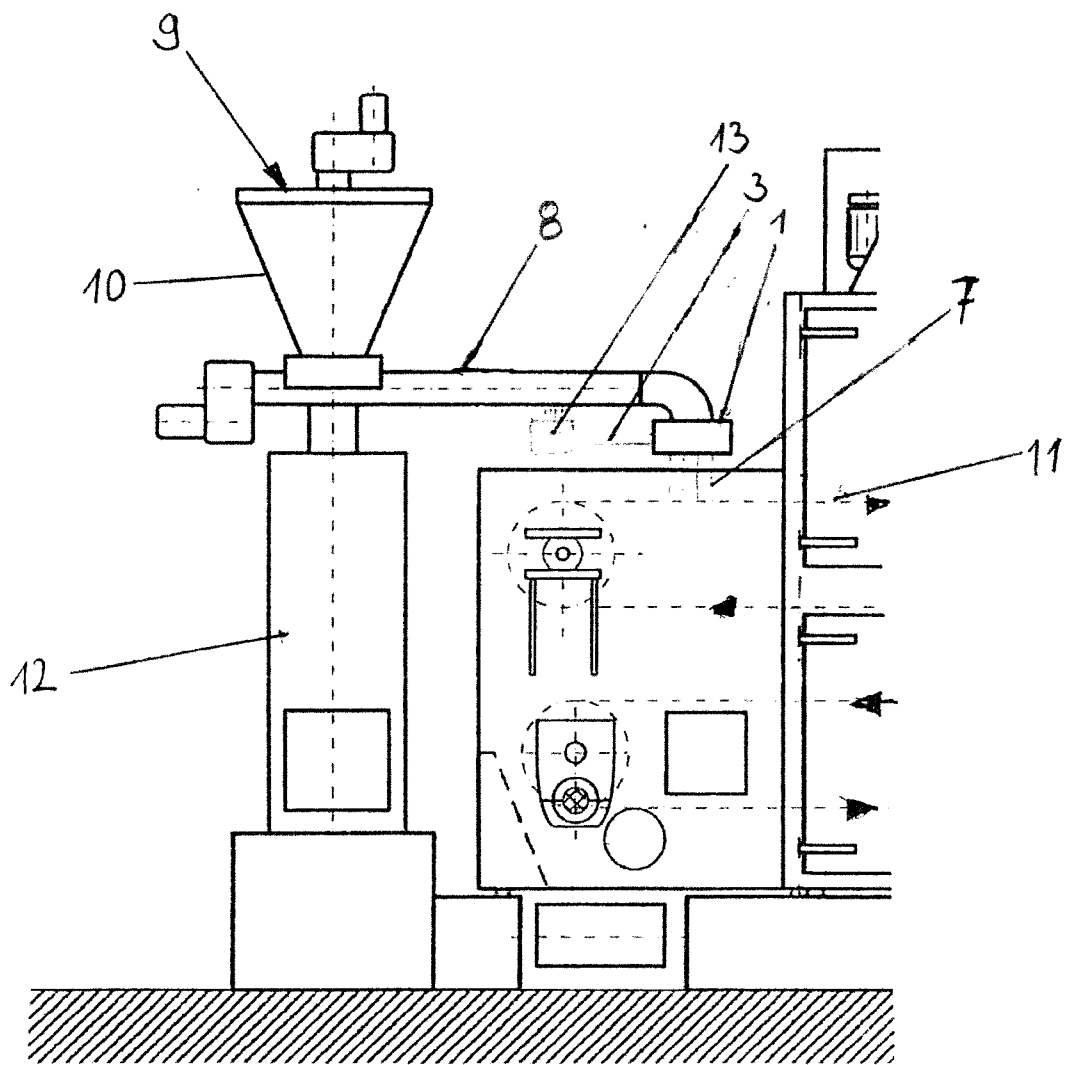


Fig. 2



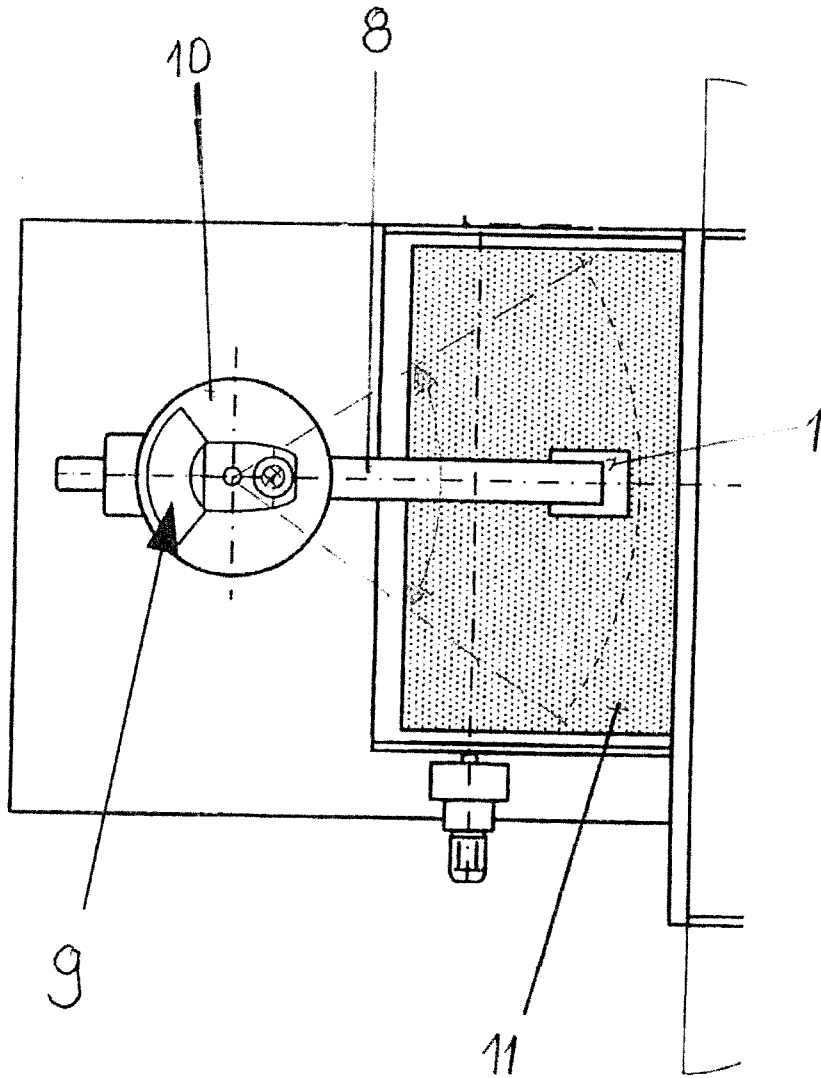


Fig. 4

