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(54) Benævnelse: **Sønderdeling af formalingsgods i en vertikal valsemølle.**

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Comminution of grinding stock in a vertical roller mill

The invention relates to a method for the comminution of grinding stock in a vertical roller grinding mill and to a vertical roller grinding mill, the grinding stock being delivered upstream of at least one grinding roller in order to form a grinding bed and being comminuted between a grinding table and at least one grinding roller.

In vertical roller grinding mills, material distribution on the grinding table depends on many factors (grinding stock, rotational speed, grinding bed height, feed point, etc.) which sometimes even influence one another.

DD 106 953 A1 and DE 44 43 099 A1 disclose methods for the comminution of grinding stock in a vertical roller grinding mill, the grinding stock being delivered to at least one grinding roller in order to form a grinding bed and being comminuted between a grinding table and the at least one grinding roller. On account of the geometry of the grinding roller, a grinding bed of differing height is formed over the width of the grinding roller.

DD 225 634 A1 discloses a roller grinding mill with a feed device, by means of which a grinding bed formed as uniformly as possible can be achieved.

DE 196 51 103 A1 addresses the problem of air included in the grinding bed and, in order to deaerate the grinding stock located on the grinding table, proposes to feed the grinding stock to the grinding table in layers, the fine stock fraction forming essentially a lower first grinding stock layer and the coarse stock fraction forming essentially a second grinding stock layer, lying above it, in the grinding bed. According to a first variant, the grinding stock is fed centrally, whereas, in a second exemplary embodiment, separate delivery upstream of each grinding roller takes place.

To improve the grinding stock drawing-in conditions of the grinding roller and to ensure more efficient grinding, DE 197 23 100 A1 proposes stock guide elements or stock guide blades which are held on common carrying arms arranged above the grinding table and in this case can be set in respect of their elevation and/or in respect of a stock guide direction.

Nevertheless, in spite of these known measures, during grinding operation vibrations repeatedly occur and are then kept low by means of a high grinding bed or an injection of water at the expense of grinding efficiency.

The object on which the invention is based, therefore, is to improve the method for the comminution of grinding stock in a vertical roller grinding mill and the vertical roller grinding mill required for this purpose, to the effect that vibrations are further reduced and grinding efficiency is increased.

This object is achieved, according to the invention, by means of the features of Claims 1 and 7.

In the method according to the invention for the comminution of grinding stock in a vertical roller grinding mill, the grinding stock is delivered upstream of at least one grinding roller in order to form a grinding bed and is comminuted between a grinding table and the at least one grinding roller, the grinding bed which is being formed being set at a differing height over the width of the grinding roller by means of a delivery device.

The vertical roller grinding mill according to the invention for the comminution of grinding stock has a grinding table and at least one grinding roller cooperating with the grinding table and also a delivery device in order to deliver the grinding stock to the at least one grinding roller, a grinding bed being formed at the same time. The delivery device is designed for the targeted setting of a differing height, over the width of the grinding roller, of the grinding bed which is being formed.

In the conventional operation of a vertical roller grinding mill, an attempt is made to deliver the grinding stock to the grinding roller at as uniform a height as possible. With the aid of a stock guide device, such as is known, for example, from DE 197 23 100 A1, this can take place relatively reliably even when the vertical roller grinding mill is operated in different ways. By means of the delivery device according to the invention, it is possible to set not only a uniform height of the grinding bed over the width of the grinding roller, but also a grinding bed which, for example, rises or falls in its height towards the grinding table margin. A grinding bed height rising towards the grinding table margin is expedient particularly when the vertical roller grinding mill is to be operated at maximum throughput. Since the circumferential speed of the grinding table rises in the direction of the grinding table margin, the comminuting action is also greatest there. If, by contrast, the grinding roller is already partially worn, an increase in efficiency can thus be achieved when the grinding bed falls in height towards the grinding table margin and the radially inner region is thus first to be used. If, however, the vertical grinding mill is to be operated with minimum energy consumption, a grinding bed with a uniform height over the width of the grinding roller will be set. The grinding bed can thus be optimized in its height in a manner targeted at the de-

sired mode of operation in each case, with the result that, in the respective mode of operation, vibrations are reduced and grinding efficiency is increased.

Further refinements of the invention are the subject-matter of the subclaims.

The delivery device is preferably designed such that the height of the grinding bed can be set such that it can be varied continuously or in steps in the direction towards the grinding table margin. Furthermore, there may be provision whereby the width of the grinding bed is limited by the delivery device and is adapted to the width of the grinding roller. Moreover, the grinding stock may selectively be fed in the middle of the grinding table and be guided to the delivery device via guide devices or it is delivered directly to a delivery device assigned to each grinding roller.

According to a further refinement of the invention, the height of the grinding bed is continuously readjusted, during comminution, over the width of the grinding roller as a function of at least one operating parameter, for example quiet running or power consumption. For this purpose, a suitable control and regulating device is provided, which is connected to at least one measuring device for detecting the operating parameter and to the delivery device.

The delivery device is preferably formed by one or two, most preferably three or more slides which are arranged next to one another over the width of the grinding rollers and can be set identically or differently in the distance from the grinding table.

According to an exemplary embodiment of the invention, the delivery device has lateral boundaries for the grinding bed, the distance between which corresponds approximately to the width of the grinding roller. In this case, the lateral boundary pointing towards the middle of the grinding table may have a grinding stock delivery orifice.

Furthermore, downstream of the grinding roller, a stripping device for stripping off the ground grinding stock from the grinding table is provided. What is considered particularly as a vertical roller grinding mill is an air-swept grinding mill or an edge mill.

Further advantages and refinements of the invention are explained in more detail below by means of the following description and the drawing.

In the drawing:

Fig. 1 shows a diagrammatic top view of a vertical roller grinding mill according to a first exemplary embodiment,

Fig. 2 shows a side view of the vertical roller grinding mill according to Fig. 1,

Fig. 3 shows a diagrammatic top view of a vertical roller grinding mill according to a second exemplary embodiment,

Fig. 4 shows a side view of the vertical roller grinding mill according to Fig. 3,

Fig. 5 shows a diagrammatic illustration of the delivery device with three slides which are set such that a grinding bed of uniform height is obtained,

Fig. 6 shows a diagrammatic illustration of the delivery device with three slides which are set such that a grinding bed rising in height towards the grinding margin is obtained,

Fig. 7 shows a diagrammatic illustration of the delivery device with three slides which are set such that a grinding bed falling in height towards the grinding margin is obtained,

Fig. 8 shows a diagrammatic illustration of the delivery device with one slide which is set such that a grinding bed falling in height towards the grinding margin is obtained,

Fig. 9 shows the diagrammatic illustration of a material wave building up upstream of the grinding roller, and

Fig. 10 shows a diagrammatic illustration of a grinding bed set optimally in height by means of the delivery device.

The vertical roller grinding mill illustrated in Figures 1 and 2 has a grinding table 1 and a plurality of grinding rollers 2. In this case, selectively, the grinding table and/or the grinding rollers can be driven. In the exemplary embodiment illustrated, a drive 3 is illustrated, for example, for one of the grinding rollers 2. Normally, however, at least two grinding rollers, preferably all the grinding rollers, are driven, in so far as the vertical roller grinding mill does not only have a grinding table drive.

In the exemplary embodiment illustrated, each grinding roller 2 is assigned a delivery device 4, with the aid of which grinding stock 5 is delivered to the grinding roller 2, a grinding bed 50 being formed at the same time. The said delivery device is composed essentially of a shaft 40 with a material delivery orifice 41 and with lateral boundaries 401, 402 which limit the width of the grinding bed 50 and the distance between which corresponds essentially to the width b of the grinding roller 2. Furthermore, three slides 43, 44, 45 are provided, which are arranged next to one another over the width of the grinding rollers and can be set at an identical or different distance from the grinding table 1 and thereby define the outlet orifice 42.

The position of the slides 43, 44, 45 according to Fig. 1 is illustrated once again in a front view in Fig. 6. The slides 43, 44, 45 can be individually set singularly or as a group by means of suitable drives 46, 47, 48, for example by means of hydraulic cylinders. The height of the grinding bed 50 which is being formed according to Fig. 6 is set by the slides such that it rises in steps in the direction towards the grinding table margin 10. Such a position of the slides is useful, above all, when the vertical roller grinding mill is to be operated at maximum throughput.

Fig. 7 shows a position of the slides 43-45 in which the height of the grinding bed 50 rises inwards. Such a position is expedient when the inner regions of the running surface of the grinding roller 2 are already worn to a relatively great extent.

In Fig. 5, the slides 43, 44, 45 are set at an identical distance from the grinding table. A grinding bed of uniform height is thus also set, thereby making it possible for the vertical roller grinding mill to have a mode of operation which is beneficial in energy terms. In addition to the illustrations in Figs. 5 to 7, the slides may also be set such that the height of the grinding bed falls or rises inwards and outwards from the middle. Such a position of the slides is useful, above all, when the axial load and therefore axial vibrations of the grinding roller are to be reduced.

Instead of three single slides arranged next to one another, two or more than three slides may, of course, also be provided. Moreover, Fig. 8 shows an exemplary embodiment with a single slide 49 which extends over the entire width b of the grinding roller and the lower edge 490 of which can be oriented to be straight or oblique to the grinding table 1 according to the grinding bed 50 to be formed. The height can thereby be increased or reduced continuously over the width of the grinding roller.

The slides 43, 44, 45 and 49, however, not only have the task of setting the height of the grinding bed over the width of the grinding roller, but also ensure that only sufficient grinding stock is delivered to the grinding roller 2 so that there is no material wave 51 formed upstream of the grinding roller 2, as illustrated in Fig. 9, but instead a situation occurs, as is illustrated in Fig. 10. The formation of a material wave 51 would otherwise lead to considerable vibrations and to an impairment in quiet running.

Downstream of each grinding roller 2, a stripping device 7 for diverting the ground grinding stock 5 from the grinding table 1 is provided.

Within the scope of the invention, however, it is also conceivable that the grinding stock 5 is fed to the grinding table 1 via a central feed device 6, as illustrated in the exemplary embodiment according to Figs. 3 and 4. Here, too, each grinding roller 2 is assigned a delivery device 4 which again has a plurality of slides 43, 44, 45 arranged next to one another or a single slide 49, with the aid of which the height of the grinding bed 50 can be set over the width of the grinding roller. Here, too, the delivery device has a kind of shaft 40, the material introduction orifice 41 of which is not, however, at the upper end of the shaft, but instead is arranged in the lateral boundary 401 pointing towards the middle of the grinding table. The grinding stock 5 fed in the middle of the grinding table 1 via the feed device 6 arrives as a result of the centrifugal force action of the rotating grinding table 1 at the material introduction orifices 41 and passes via these into the delivery device 4.

The grinding stock 5 comminuted by the grinding rollers 2 is, in turn, stripped off downstream of the grinding roller 2 via the grinding table margin 10 by means of stripping devices 7. This stripping device is expediently arranged such that it acts on its other side as a guide device for guiding the grinding stock 5 to the introduction orifices 41 of the delivery devices 4.

The vertical roller grinding mill may be designed, for example, as an air-swept grinding mill or as an edge mill. Where an edge mill is concerned, the comminuted grinding stock 5 diverted via the grinding table margin 10 falls downwards and is suitably drawn off there. In the case of an air-swept grinding mill, an air stream flows from below upwards past the grinding table margin 10 and at the same time picks up the comminuted grinding stock which, together with the air stream, passes into a separator mostly arranged above the grinding table. When the air-swept grinding mill is operated with a hot air stream, in addition to comminution, drying of the grinding stock can also take place at the same time. Since an

edge mill and an air-swept grinding mill are sufficiently known from the prior art, further details are therefore not dealt with.

Via a suitable control and regulating device 8, the drives 46-48 of the slides 43-45 can be activated even during the comminuting operation. The mode of operation of the vertical roller grinding mill can thus be influenced in a targeted manner as a function of at least one operating parameter by a variation in the height of the grinding bed over the width of the grinding roller 2. For this purpose, the control and regulating device 8 is connected to a suitable measuring device 9. This measurement device can, for example, detect at least one of the following operating parameters: quiet running, power consumption of the drives of grinding rollers and/or grinding table, etc.

With the aid of the slides, the stability of the grinding bed 50 can be markedly increased, in that the grinding bed height over the width of the grinding roller is adapted to the mode of operation, the grinding stock and the state of wear of the grinding roller. A further increase in grinding bed stability occurs owing to the fact that a material wave 51, as shown in Fig. 9, is avoided. Moreover, the grinding stock can be delivered by the slides in a highly targeted manner and so as to be distributed optimally over the width of the grinding roller. This has a positive effect upon quiet running and grinding efficiency and, moreover, stabilizes the material bed.

PATENTKRAV

1. Fremgangsmåde til sønderdeling af formalingsgods (5) i en vertikal valsemølle, hvorved formalingsgodset (5) tilføres foran i det mindste een formalingsvalse (2) med henblik på dannelse af et formalingsleje (50) og sønderdeles mellem en formalingstallerken (1) og den i det mindste ene formalingsvalse (2),
k e n d e t e g n e t v e d , at formalingslejet (50), som dannes hen over formalingsvalsens (2) bredde (b), indstilles til forskellig højde ved hjælp af en tilførselsindretning.

2. Fremgangsmåde ifølge krav 1,
k e n d e t e g n e t v e d , at formalingslejets (50) højde indstilles således, at den i retning hen imod formalingstallerkenens rand (10) ændrer sig kontinuerligt eller trinvist.

3. Fremgangsmåde ifølge krav 1,
k e n d e t e g n e t v e d , at det formalede formalingsgods (5) efter formalingsvalsen (2) ledes bort fra formalingstallerkenen (1).

4. Fremgangsmåde ifølge krav 1,
k e n d e t e g n e t v e d , at formalingslejets (50) bredde begrænses ved hjælp af tilførselsindretningen (4) og tilpasses til formalingsvalsens (2) bredde.

5. Fremgangsmåde ifølge krav 1,
k e n d e t e g n e t v e d , at formalingsgodset (5) tilføres i formalingstallerkenens (1) midte og via ledeindretninger ledes til tilførselsindretningen (4).

6. Fremgangsmåde ifølge krav 1,
k e n d e t e g n e t v e d , at formalingslejets (50) højde hen over formalingsvalsens (2) bredde efterreguleres under sønderdelingen i afhængighed af i det mindste een driftsparameter.

7. Vertikal valsemølle til sønderdeling af formalingsgods (5), med en formalingstallerken (1) og i det mindste en formalingsvalse (2), der virker sammen med formalingstallerkenen (1), såvel som med en tilførselsindretning

(4) med henblik på tilførsel af formalingsgodset (5) til den i det mindste ene formalingsvalse (2) under dannelse af et formalingsleje (50).

8. Vertikal valsemølle ifølge krav 7,
k e n d e t e g n e t v e d , at tilførselsindretningen (4) i det mindste omfatter én eller to, fortrinsvis tre skydere (4, 44, 45; 49), som hen over formalingsvalsens (2) bredde (b) er anbragt ved siden af hinanden og kan indstilles med samme eller forskellig afstand til formalingstallerkenen (1).

9. Vertikal valsemølle ifølge krav 7,
k e n d e t e g n e t v e d , at tilførselsindretningen (4) er udformet som tilførselsskakt (40).

10. Vertikal valsemølle ifølge krav 7,
k e n d e t e g n e t v e d , at tilførselsindretningen (4) omfatter sideværts begrænsninger (401) for formalingslejet (50), og hvis indbyrdes afstand i det væsentlige svarer til formalingsvalsens (2) bredde (b).

11. Vertikal valsemølle ifølge krav 10,
k e n d e t e g n e t v e d , at den sideværts begrænsning, som vender mod formalingstallerkenens (1) midte, omfatter en tilførselsåbning (41) for formalingsgods.

12. Vertikal valsemølle ifølge krav 7,
k e n d e t e g n e t v e d , at der efter formalingsvalsen (2) er tilvejebragt en afstrygerindretning (7) til bortledning af det formalede formalingsgods (5) fra formalingstallerkenen (1).

13. Vertikal valsemølle ifølge krav 7,
k e n d e t e g n e t v e d , at den vertikale valsemølle er udformet som luftstrøm-mølle eller kollergang.

14. Vertikal valsemølle ifølge krav 7,
k e n d e t e g n e t v e d , at der i det mindste er tilvejebragt en måleindretning (9) til detektering af en driftsparameter i den vertikale valsemølle samt en styrings-/reguleringsindretning (8), hvorved styrings-/reguleringsindretningen (8) står i forbindelse med måleindretningen (9)

og tilførselsindretningen (4) med henblik på indstilling af formalingslejets (50) højde i afhængighed af driftsparameteren.

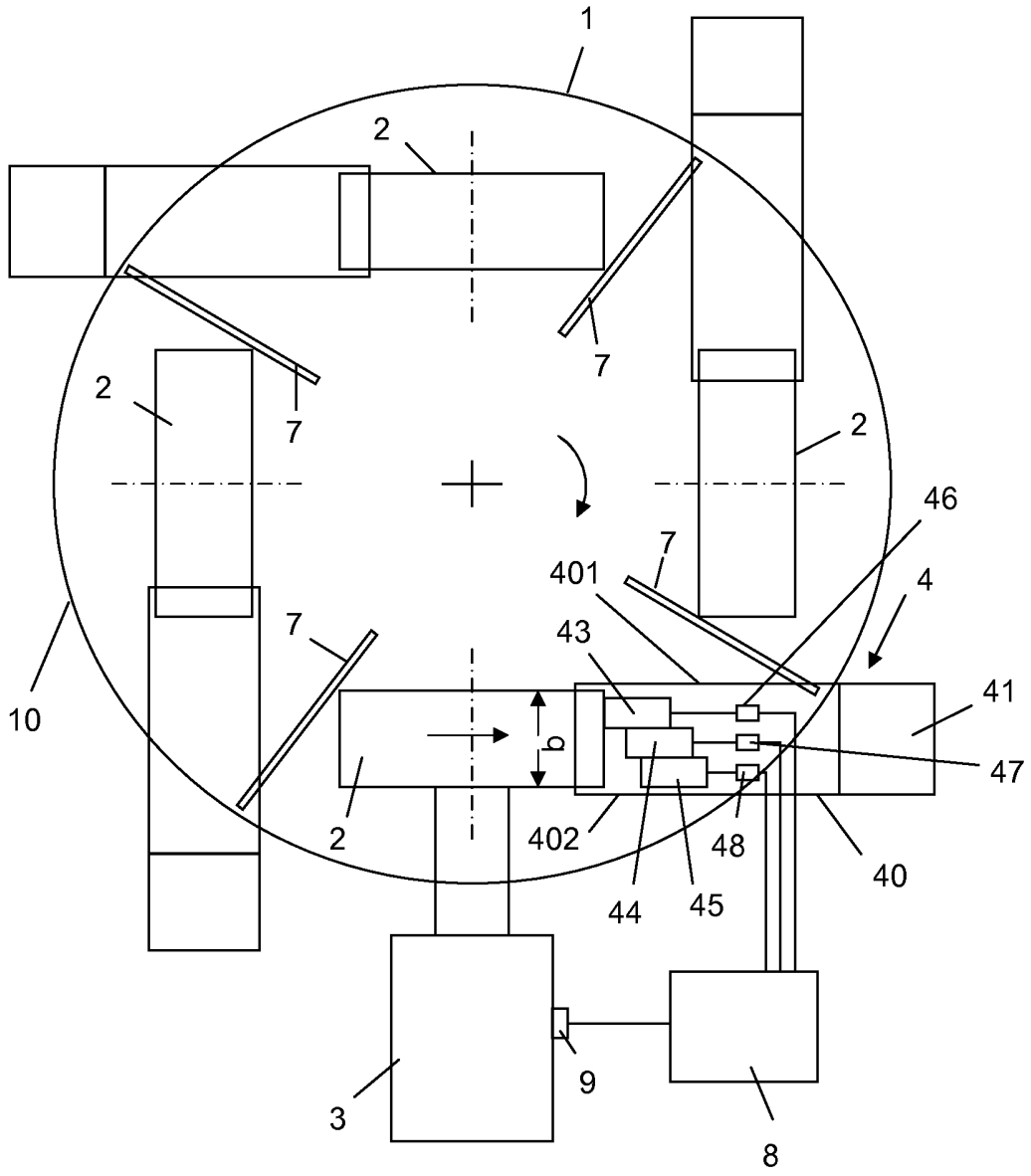

Fig. 1

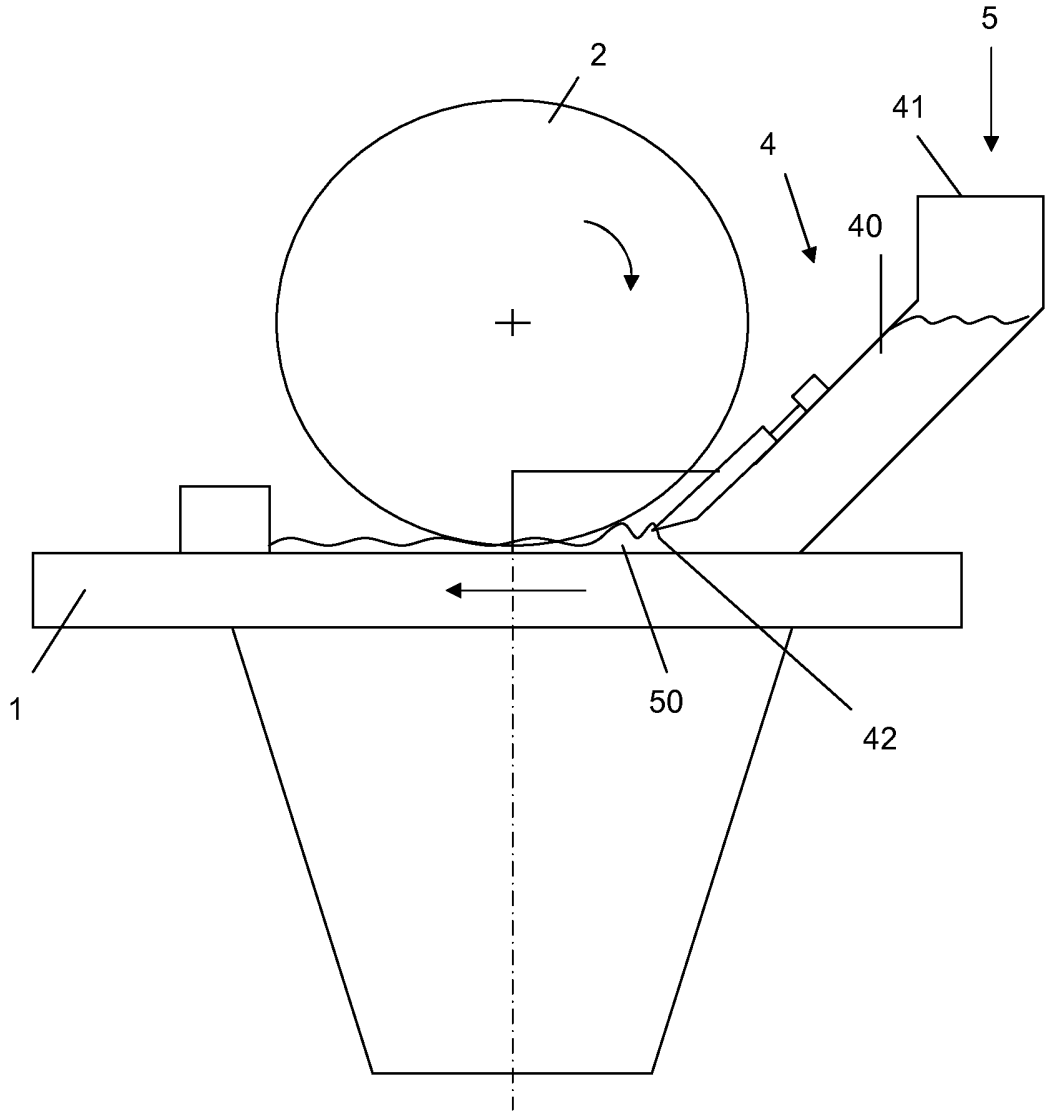

Fig. 2

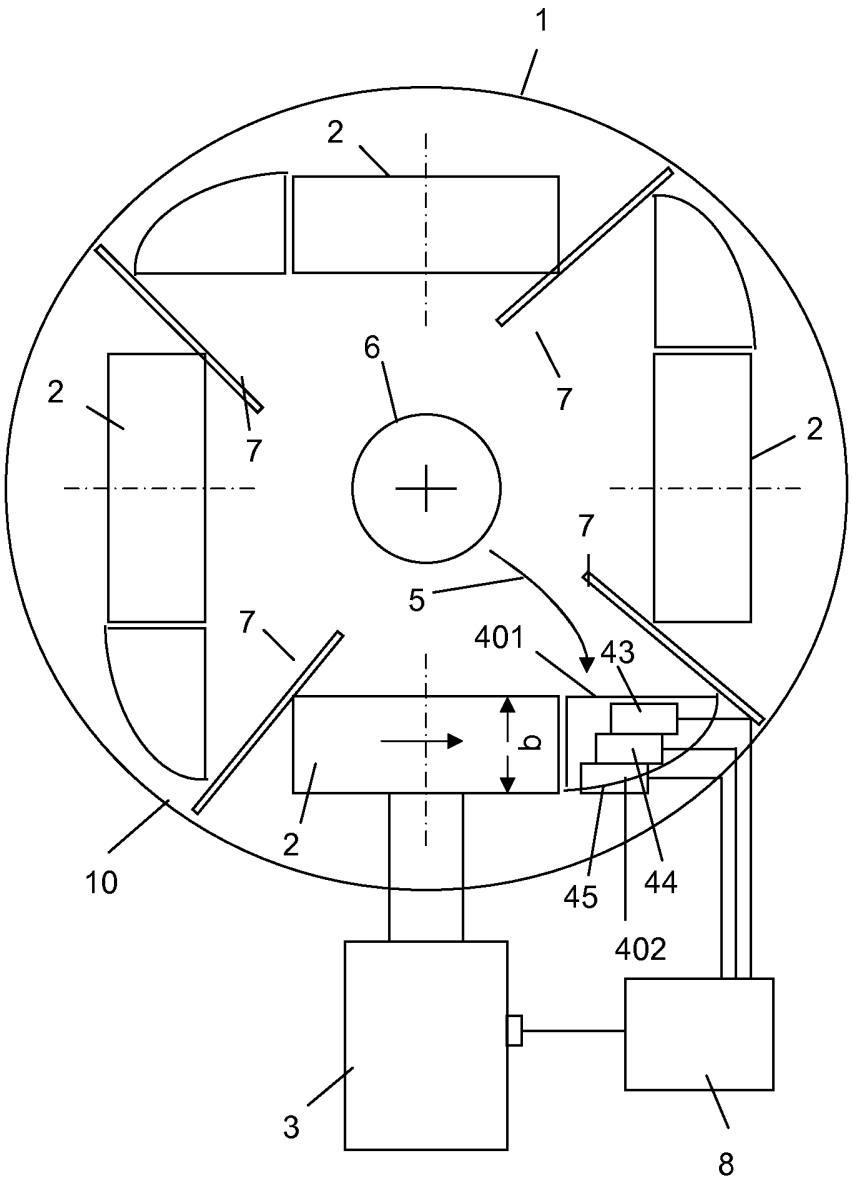

Fig. 3

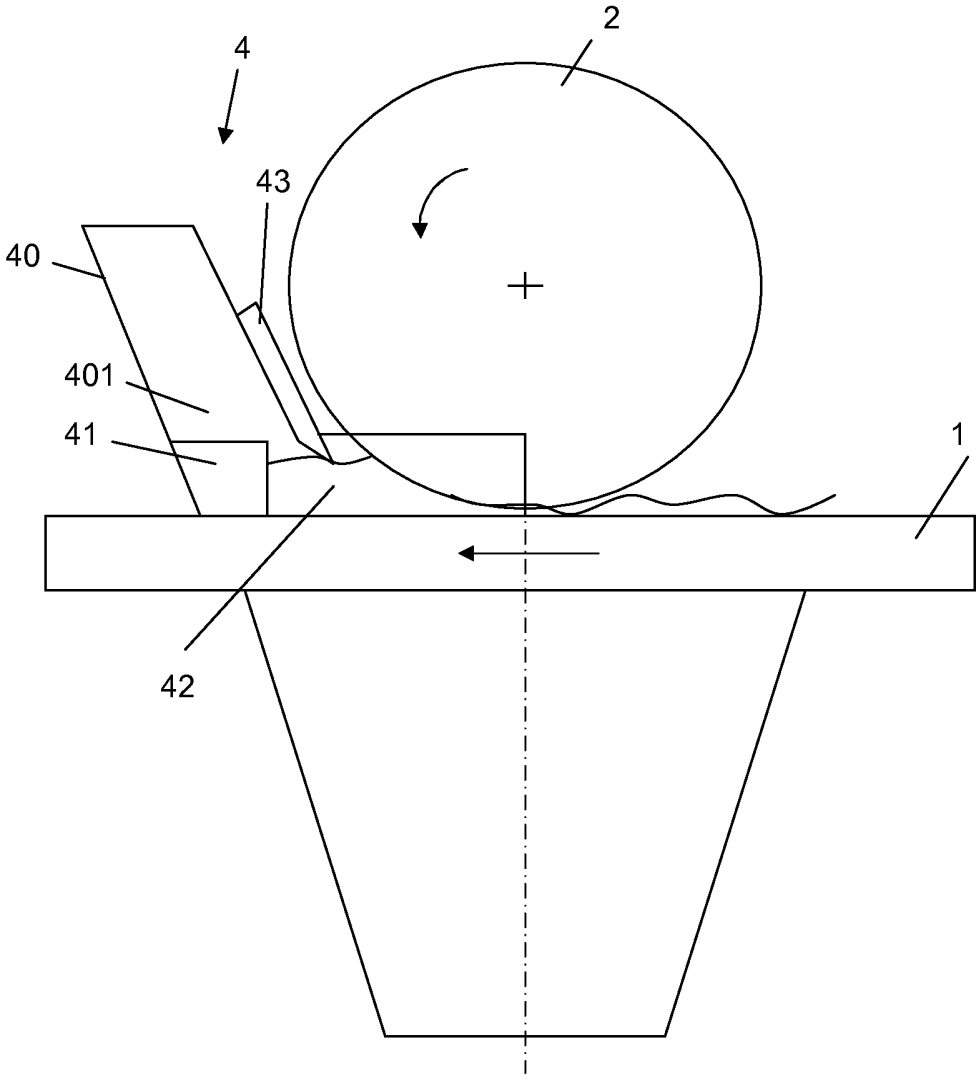

Fig. 4

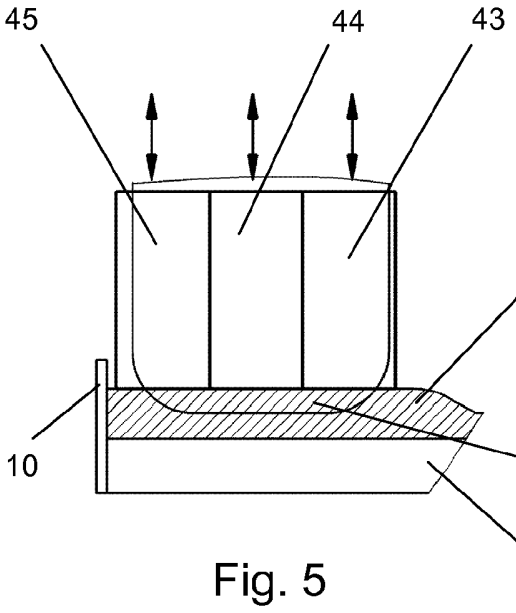

Fig. 5

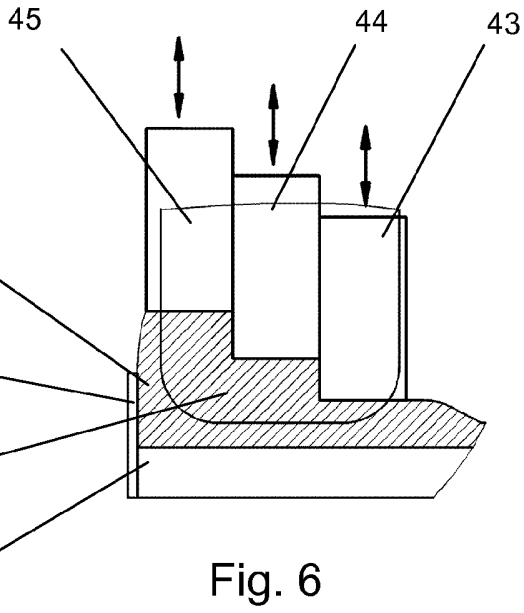

Fig. 6

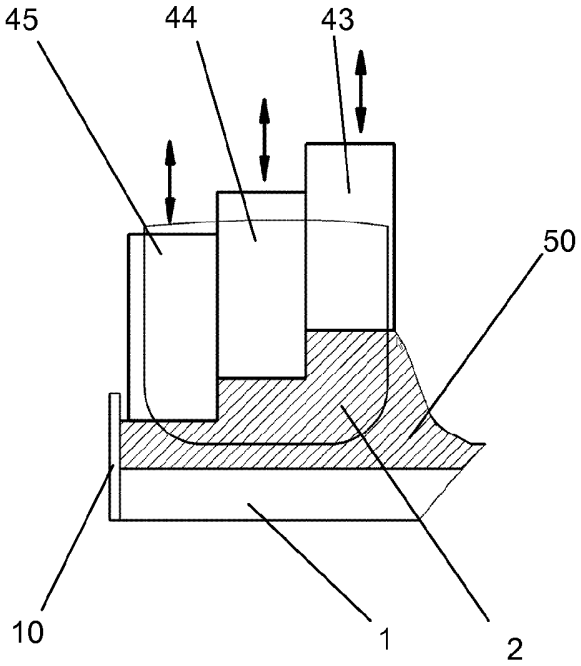

Fig. 7

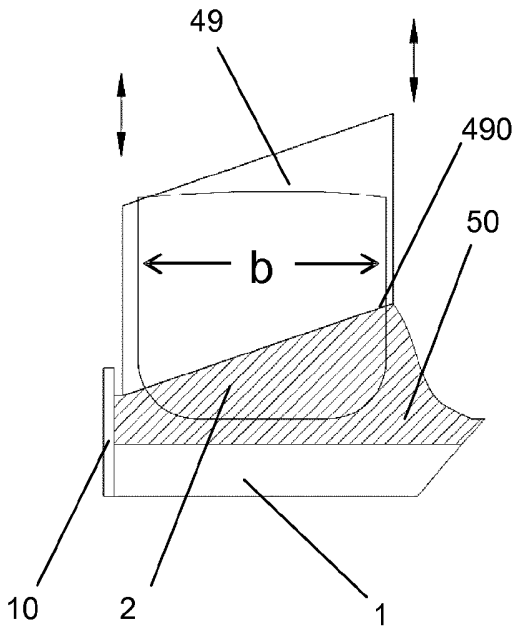

Fig. 8

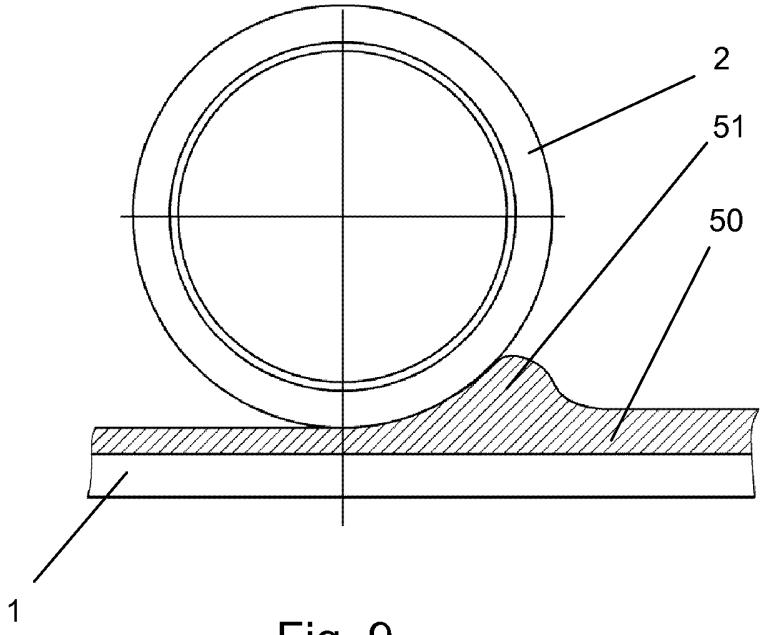

Fig. 9

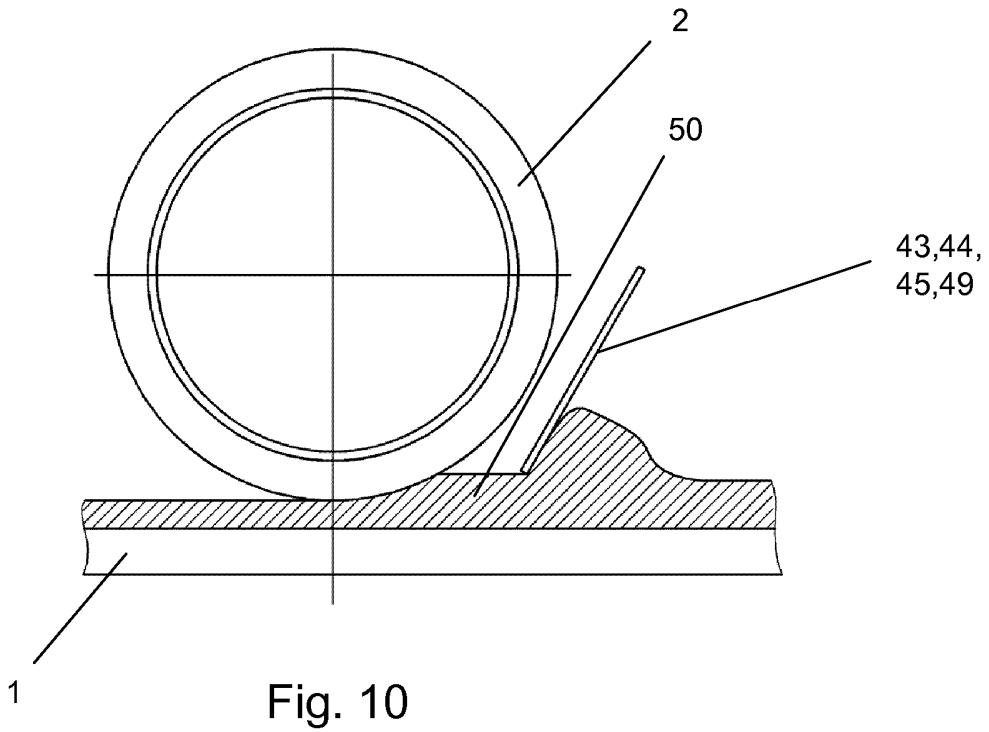

Fig. 10