

(19) **DANMARK**

(10) **DK/EP 4294572 T3**



(12) **Oversættelse af
europæisk patentskrift**

Patent- og
Varemærkestyrelsen

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- (51) Int.Cl.: **B 02 C 4/02 (2006.01)** **B 02 C 4/28 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2024-11-04**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2024-09-18**
- (86) Europæisk ansøgning nr.: **21839491.4**
- (86) Europæisk indleveringsdag: **2021-12-15**
- (87) Den europæiske ansøgnings publiceringsdag: **2023-12-27**
- (86) International ansøgning nr.: **EP2021086001**
- (87) Internationalt publikationsnr.: **WO2022174957**
- (30) Prioritet: **2021-02-16 DE 102021103573**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **Højtryksvalsepresse**
- (56) Fremdragne publikationer:
EP-A1- 2 314 723
EP-A2- 0 607 853
US-A- 4 231 729
US-A- 4 905 917

HIGH-PRESSURE ROLLER PRESSDescription:

The invention relates to a roller press or high-pressure roller press, particularly a material bed roller mill or a compacting machine, which comprises two press rollers that are rotatably mounted in a press frame (and driven in opposite directions), wherein a filling funnel having a pressure zone is formed between said press rollers with a nip arranged at the height of the roller axes, wherein the gap width of said nip is variable during the operation of the roller press, wherein the filling funnel between the press rollers (or the nip) is delimited at the roller end faces by (two) delimiting plates arranged laterally next to the press rollers, and wherein the delimiting plates are fastened on the press frame in a movable manner and under the application of a force (or pretension) in such a way that the delimiting plates can be pushed back against the applied force and therefore also positioned obliquely during the operation of the roller press (e.g. in the course of an oblique positioning of a roller).

A roller press of this type particularly serves for the comminution of materials, in particular highly abrasive materials such as ore, cement clinker, slag or ceramic base materials, or for compaction processes, e.g. of fertilizers. For example, the roller press serves for high-pressure comminution processes and is then also referred to as a material bed roller mill. However, the roller press may alternatively also be used for the compaction of materials. In material bed roller mills, the individual particles of the feed material are not crushed between the surfaces of the two rollers as it is the case in a crusher, but rather compressed in a material bed under high pressure and thereby comminuted in a highly efficient manner. In the compaction of materials in a roller press, the feed

material is compressed into a flake between the rollers (e.g. during the compaction of fertilizers). The two rollers of a roller press are driven in opposite directions. It is preferred that one of the press rollers is realized in the form of a fixed roller and the other press roller is realized in the form of a loose roller, wherein the loose roller is movable relative to the fixed roller, namely such that it can be adjusted against the fixed roller with variable gap width. To this end, the loose roller can be adjusted against the fixed roller, e.g. hydraulically and/or pneumatically, with the aid of force generating means and therefore is, so to speak, supported against a hydro-pneumatic spring. The gap between the rollers is adjusted automatically until a certain pressure acts between the rollers. In this case, the gap width results from the ratio of the pressing force of the hydraulic system to the reaction forces originating from the material to be processed.

The nip or the filling funnel with the pressure zone is laterally delimited by delimiting plates that are fastened on the press frame and also referred to as "cheek plates" or filling funnel delimitations or filling funnel delimiting plates in practical applications. Their shape is frequently adapted to the zone (the "filling funnel") between the press rollers that narrows in a funnel-shaped manner in the rotating direction of the press rollers or in the conveying direction, respectively.

If a uniform supply of the feed material over the width of the rollers cannot be ensured in practical applications, oblique positions of the rollers relative to one another or of the loose roller relative to the fixed roller are permitted such that a nip with non-identical gap width over the width of the rollers can also be adjusted during the operation of the roller press. In press rollers of conventional size, the magnitude of such oblique positions

in the edge region lies between several millimeters and several centimeters. This is the reason why the lateral delimiting plates are not rigidly fastened on the press frame, but rather can be pushed back under the application of a force, e.g. in a spring-loaded or hydraulically pretensioned manner. The use of such spring-mounted filling funnel delimiting plates has proven itself excellently in practical applications.

However, the delimiting plates are subjected to significant wear in practical applications. It is therefore known to provide the delimiting plates with a wear protection layer. For example, DE 10 2018 113 440 A1 describes a roller press, in which plate-shaped wear protection elements on the one hand and pin-shaped wear protection elements on the other hand are used for the wear protection layer of the delimiting plates in the high-pressure zone.

In order to reduce the friction in the region of the lateral delimiting plates and therefore the wear, WO 2006/124425 A1 proposes to provide a plurality of movable elements, which are arranged in a matrix-like manner and may be realized, e.g., in the form of rolls, on the lateral delimiting plates. The rolls distributed on the "cheek plates" in a matrix-like manner are intended to allow a movement of the surface with the material and to thereby reduce the friction and consequently the wear.

According to an alternative concept, the lateral delimiting plates fastened on the press frame are eliminated and delimiting elements such as circumferential flanges are instead fastened on one of the rollers itself, wherein said lateral flanges are connected to one of the rollers in a rotationally fixed manner such that they rotate with the rollers and consequently are moved with the speed of the material. This in fact makes it possible to reduce the wear in the region of the delimiting elements. However, it is

disadvantageous that these lateral flanges do not readily allow oblique positioning of the loose roller such that a homogenous material feed has to be ensured over the width of the machine. Such a roller mill with lateral flanges for delimiting the nip is described, for example, in DE 37 01 965 A1. An elastic deformation of the flanges is permitted in DE 10 2018 108 690 A1 in order to also allow a certain oblique position between the rollers in such a solution with lateral flanges. However, such measures are relatively elaborate.

Furthermore, US 647 894 discloses a roller press with "cheek plates" that are laterally mounted in a fixed manner, wherein rolls that laterally delimit the nip are provided instead of the normally provided lower sections of the "cheek plates." Consequently, these rolls replace the lower portion of the conventional delimiting plates and are intended, in particular, to reduce the wear. However, the cheek plates and the rolls are mounted stationarily during the operation of the roller press. The rolls can only be moved with the aid of screw bolts for adjustment purposes.

Lateral feeder chute delimitations equipped with special wear protection means are provided in a roller press that serves for the production of briquettes. A frame, in which multiple rolls are arranged underneath one another, can be inserted into a cutout of the feeder chute delimiting plates to this end (see DE 665 141).

In another known device for rolling strips from metal powder, a loose disc is arranged on each side of one of the rollers so as to revolve with this roller in order to laterally delimit the roll pass (DE 11 16 036). Similar devices are known from US 2 904 829 and US 4 231 729.

Furthermore, roller presses for the compaction of directly reduced iron at high temperatures are also known (see EP 2

314 723 B1 and EP 3 358 024 A1). Lateral "cheek plates" are also provided in these presses. The upper regions of the "cheek plates" are provided with indentations that allow the oblique arrangement of the screw conveyors.

DE 36 35 762 A1 describes a roller mill, in which the end walls of the feeder chute are provided with special accumulation elements that should have an open honeycomb structure.

EP 2 505 346 A1 describes delimiting plates for briquetting materials with high moisture content, wherein the delimiting plates have a curved region, into which special bodies are integrated such that drainage channels are formed.

US 1 050 183 ultimately discloses a roller press with lateral delimiting plates that, so to speak, are realized in a box-shaped manner and form material pockets for receiving material.

Furthermore, older and not pre-published German patent application DE 10 2020 104 526 A1 relates to a high-pressure roller press of the initially described type with delimiting plates that can be pushed back against an applied force during the operation of the roller press. One individual roll is respectively fastened on the delimiting plates at the height of the nip, wherein said roll is mounted so as to be rotatable about its roll axis and laterally delimits the nip. Consequently, one individual roll is respectively integrated into each of the delimiting plates.

Based on the above-described prior art, the invention aims to develop a high-pressure roller press of the initially described type, particularly a material bed roller mill or compacting machine, which has a simple construction and is

characterized by an improved mode of operation and, in particular, a high comminuting or compacting performance.

In order to attain this objective in a generic high-pressure roller press, which is equipped with delimiting plates that are acted upon by a force, the invention proposes that (only) one individual roll is respectively provided in addition to the delimiting plates and arranged laterally next to and consequently at the end faces of the rollers at the height of the nip, wherein said roll is mounted so as to be rotatable about its roll axis and laterally delimits the nip, and wherein the rolls are movable relative to the respective delimiting plate (e.g. in the horizontal direction) and respectively acted upon by a force in the direction against the roller end face in such a way that the rolls can be pushed back against the applied force during the operation of the press. Consequently, one individual roll is assigned to each of the two lateral delimiting plates such that, all in all, (only) two rolls that can be respectively moved relative to the delimiting plates (in the horizontal direction) are provided. The roll axes are oriented perpendicular to the roller axes or perpendicular to the stationary roller axis of the fixed roller (and perpendicular to the transport direction of the material through the nip).

The invention initially is based on the realization that it is advantageous to provide the generally known delimiting plates (cheek plates), which are acted upon by a force, such that - in contrast to the solution with delimiting flanges on a roller - an oblique position of the rollers or an oblique position of the loose roller relative to the fixed roller can be easily permitted. This design has the enormous advantage that an overload of the machine or the filling funnel delimiting devices is reliably prevented without having to ensure a uniform supply of the feed material over the width of the rollers. According to the

invention, the friction in the region of the high-pressure zone is simultaneously reduced in that one respective individual roll is additionally arranged in the region of the delimiting plates that can be pushed back. One such individual roll in the region of a delimiting plate does not mean that multiple rolls are arranged on top of one another, but rather that only one individual roll is rotatably arranged in the region of the high-pressure zone. However, this design does not preclude that one such individual roll is composed of multiple roll sections or roll parts that are arranged next to one another and rotatable about the same axis. However, it is preferred that these rolls or roll sections, which are arranged next to one another and rotate about the same axis, have a (one-piece) roll shell that extends continuously over the width and the circumference such that there is no risk of material getting stuck in a gap between the individual rolls or roll sections.

According to the invention, the roll is not directly mounted on the respective delimiting plate in a rotatable manner, but rather such that it can also be moved relative to the respective delimiting plate in the horizontal direction, i.e. adjusted against the roller end face independently of the delimiting plate. It is preferred that this is constructively realized in that the rolls are fastened on the press frame in a movable manner and under the application of a force independently of the respective delimiting plate. Consequently, the delimiting plates, as well as the rolls, respectively can be pressed against the respective roller end face or are acted upon in the direction against the roller end face, e.g., with the aid of a spring device, but preferably with respectively separate spring devices. During the operation of the roller press, the delimiting plates therefore can preferably be pushed back by the material independently of the rolls. The spring devices acting upon the rolls on the one hand and

the spring devices acting upon the delimiting plates on the other hand preferably are adapted to one another in such a way that the rolls exert a greater pressure upon the material (in the filling funnel) than the delimiting plates. Consequently, the delimiting plates preferably can be pushed back more easily than the rolls during the operation of the roller press.

In a preferred embodiment, the respective rolls are rotatably mounted on or in at least one roll holder that is fastened on the press frame in a movable manner and acted upon by a force, preferably independently of the respective delimiting plate. Consequently, the roll holder carries the rotatable roll and preferably the bearings, in which the roll is rotatably mounted. The roll holder itself is acted upon by a force, e.g. with a corresponding spring device. This makes it possible to adjust the roll against the end face of the rollers independently of the delimiting plate, e.g. with its own spring device. In this case, it is advantageous that the delimiting plates respectively have an opening, through which the associated roll extends. It is preferred that the roll is rotatably mounted, e.g. on the aforementioned roll holder, in a region behind the delimiting plate. The roll regionally extends through the opening in the delimiting plate, namely in the region of the end faces of the press rollers.

The roll holder preferably is realized in the form of a roll holder that is pivotable about a rotational axis, particularly in the form of a rocker that is coupled to the press frame so as to be pivotable about a rotational axis. The respective roll holder may alternatively be arranged (on the press frame) in a linearly displaceable manner, e.g. on a respective horizontal linear guide, i.e. the roll holder or the roll holders is/are formed by linearly displaceable components or the linearly displaceable roll bearings. Consequently, the delimiting plates, as well as

the roll holders, are respectively fastened on the press frame and, according to the invention, acted upon by a force independently of one another.

It is preferred that the rolls or the respective roll holder are respectively acted upon by a force with the aid of at least one spring device that is supported, for example, on the press frame and acts against the respective roll or the roll holder. However, this is not the spring device that exerts a force upon the lateral delimiting plate, but rather a separate spring device assigned to the respective roll.

The spring device for exerting a force upon the roll may be realized in the form of a mechanical spring device, e.g. in the form of a metallic spring or the like. However, it is preferred that this spring device is realized in the form of a hydraulic spring device or, alternatively, in the form of a pneumatic spring device, e.g. in the form of a hydraulic cylinder. It is particularly preferred to use a spring device, the spring force of which is variably adjustable, e.g. a spring device in the form of a hydraulic cylinder or, alternatively, in the form of a pneumatic cylinder. In this way, the spring force can be adapted to the respective circumstances (e.g. in the course of the installation), particularly in comparison with the spring force of the spring device acting upon the lateral delimiting plate. It is possible to variably adjust the spring force in the course of the installation and to keep the spring force constant during the operation of the roller press. In the context of the invention, however, it would alternatively also be possible to use a spring device, the spring force of which is variable or optionally also controllable during the operation of the roller press, e.g. in dependence on operating parameters of the roller press and/or measured values such as the oblique position between the rollers or the pressure in the nip.

Spring devices for the lateral delimiting plates are provided independently of the spring device for the rolls and likewise realized in the form of mechanical or hydraulic or pneumatic spring devices. It is preferred to use simple mechanical spring devices such as coil springs or the like for the lateral delimiting plates. However, it is also possible, in principle, to use spring devices, the spring force of which is variable or optionally also controllable during the operation of the roller press, for the lateral delimiting plates.

According to the invention, the individual rolls that are acted upon by a force and the individual lateral delimiting plates that are acted upon by a force therefore are of particular importance (in combination).

In a particularly preferred embodiment of the invention, the delimiting plates respectively have a material guide pocket that is integrated into the delimiting plate, namely above the roll arranged in the region of the delimiting plate, such that the roll is charged or can be charged with material from above by means of this material guide pocket. A set-back material guide pocket means that the pocket is set back in relation to a front plane of the delimiting plate, wherein the front plane is the plane of the delimiting plate that faces the roller end face and is oriented parallel to the roller end face. Consequently, the material guide pocket has a rear wall that is set back in relation to this front plane and (at least) regionally spaced apart from the front plane, wherein said rear wall preferably is curved. It is particularly preferred that the material guide pocket is in a side view realized in a funnel-shaped manner with a width that narrows downward. The material guide pocket alternatively or additionally has a depth that decreases downward such that an altogether funnel-shaped material guide pocket is realized, by means

of which the material is supplied to the roll located thereunder from above.

Alternatively, the delimiting plate may have a material guide pocket that in a side view is regionally realized in a funnel-shaped manner with a width that narrows downward, but has no decreasing depth. The rear wall preferably can also be realized in a curved manner in this embodiment (with vertical rear wall).

The material guide pockets integrated into the delimiting plates, which are of particular importance in combination with the rolls, produce a surplus supply of feed material or milling material in the outer regions on the faces of the rollers and the location, at which the friction between the feed material and the delimiting plate occurs, simultaneously is shifted "outward" from the roller end face due to the set-back rear wall of the material guide pocket. In this way, a better inflow of the material takes place on the roller edges and the material is drawn into the nip in an improved manner. This counteracts the effect observed in practical applications with conventional "cheek plates" or delimiting plates, in which less material is drawn into the nip in the edge regions such that less material is also comminuted or compacted at these locations. All in all, the effectiveness of the roller press over the width of the nip is thereby improved.

The roll acted upon by a force in the region of the delimiting plate therefore is of particular importance in combination with the material guide pockets. The roll preferably is dimensioned and positioned in such a way that the upper vertex of the roll is arranged above the roller axis and/or that the lower vertex of the roll is arranged below the roller axis or the roller axes. In any case, the two rolls provided in the region of the two delimiting plates are - referred to the height - arranged in the

region of the pressure zone of the roller press. The pressure zone is defined as the lower zone of the filling funnel of the roller press, which preferably extends between the two rollers over a circumferential angle of -5° to $+15^{\circ}$, namely in the direction of the nip and referred to a straight line through the centers of both rollers. The nip lies at the height of the roller axes and therefore at a respective circumferential angle of 0° . According to this definition, the pressure zone preferably is the region that lies between $+15^{\circ}$ above the roller axis and -5° below the roller axis. The rolls are arranged in the region of the roller axes and therefore also in the region of the pressure zone. The rolls preferably are dimensioned and arranged in such a way that the upper vertices of the rolls are arranged above the pressure zone (referred to the height of the pressure zone). The lower vertices of the rolls are alternatively or additionally arranged underneath the pressure zone. The roll axes of the rolls are (approximately) arranged at the height of the roller axis (axes).

The diameter of the rolls preferably is adapted to the diameter of the press rollers in such a way that the roll diameter amounts to at least 5% of the roller diameter, preferably to at least 10% of the roller diameter. For example, the roll diameter may amount to approximately 5% to 35%, e.g. to 10% to 30%, of the roller diameter. The diameter of the press rollers typically lies between 1000 mm and 3000 mm, e.g. between 1200 mm and 2000 mm. The diameter of the roll may amount, for example, to at least 50 mm, preferably at least 100 mm, particularly at least 200 mm. The roll diameter therefore may lie, for example, between 50 mm and 1000 mm, preferably between 100 mm and 600 mm, e.g. between 200 mm and 450 mm.

The width of the roll preferably is greater than the maximum gap width of the nip and therefore greater than the

pre-adjusted zero gap plus at least the distance, by which the nip opens during the operation of the machine. The width of the roll may amount to at least 1%, preferably at least 2%, of the roller diameter, e.g. to at least 50 mm and preferably to at least 60 mm. It is particularly preferred that the width of the roll amounts to approximately 1% to 10%, e.g. to 2% to 8%, of the roller diameter. The roll therefore may have a width, for example, of 50 mm to 200 mm, e.g. 60 mm to 100 mm. In this context, the width of the roll refers to the width of the (circumferential) working surface of the roll and consequently to the width of the roll body.

The roll is intended to reduce the lateral friction in the pressure zone or high-pressure zone. In addition, the roll is intended to transport additional material into the nip from the funnel or the material guide pocket lying above the roll and consequently to convey material into the region of the nip. This is achieved, among other things, by correspondingly dimensioning and arranging the roll at the described height. The effect can be additionally improved in that the roll is provided with a profiled or structured surface (on the roll circumference). In this context, it would be possible, for example, to use pin-like wear elements (so-called "studs") of the type known, e.g., from EP 0 516 952 for outfitting the roller surface of press rollers of a material bed roller mill or wear protection elements known from DE 10 2018 113 440 A1 in the region of delimiting plates or cheek plates.

In other respects, the feed of the material to the rolls by means of the material guide pockets or material funnels can be improved by using guide installations that are suitably integrated into the material guide pockets. The delimiting plates may be alternatively or additionally provided with additional sealing plates that extend parallel to the front plane or in the front plane and partially cover the

material guide pocket on the front side. These sealing plates, which likewise improve the feed of the material from the material guide pockets into the region of the roll, are described in greater detail in the description of the figures.

It is possible, in principle, to use rolls without a drive such that the rolls are rotated, so to speak, in a passive manner by the added material moved by the press rollers. It is preferred that the rolls are (indirectly) driven by the rollers in that the rolls are pressed against the end faces of the rollers with their circumferential surfaces. The circumferential surfaces of the rolls are in any case greater or wider than the nip such that the circumferential surfaces or roll body surfaces (working surfaces) of the rolls can be pressed against the end faces of the rollers, e.g. under the application of a force, and the rolls can be driven by the rollers. However, it is also possible to respectively provide the rolls with a drive such that actively driven rolls are used, wherein these rolls preferably are driven with the same circumferential speed as the press rollers. In this way, the friction in the region of the rolls can be reduced particularly well. The rotational speed or circumferential speed may optionally also be slightly faster than that of the roller surfaces in order to optimize the conveying effect of the material in the nip.

The preferred realization of the set-back material guide pockets in the region of the delimiting plates also leads to the material being pushed into the material guide pockets over the end faces of the rollers and into the milling gap along this path. This has the advantage that the milling gap is additionally supplied with material. To this end, it may be advantageous to additionally protect the end faces of the rollers against wear such that the measures for reducing the wear, which are normally used in

the region of the circumferential surfaces of the rollers, e.g. suitable armoring, are optionally provided in the region of the end faces. Structuring may optionally also be advantageous in the region of the roller end faces in order to improve the effect of drawing in material.

In the context of the invention, it is of particular importance that an oblique position of the rollers relative to one another or an oblique position of the loose roller relative to the fixed roller is explicitly permitted. The respective roller respectively pushes the lateral delimiting plate sideward or backward in the conventional manner such that the delimiting plate rests on the two roller end faces or roller flanks. This applies analogously to the rolls, which preferably are acted upon by a separate spring force.

The invention is described below with reference to drawings that, however, merely show an exemplary embodiment of the invention. In these drawings,

Figure 1 shows a highly schematic vertical section through both rollers of a roller press,

Figure 2 shows a vertical section through the nip of an inventive roller press in the form of a detailed representation (detail),

Figure 3 shows a top view of the object according to Figure 2,

Figure 4 shows an inventive lateral delimiting plate with a roll in the form of a perspective view from inside, and

Figure 5 shows the lateral delimiting plate with a roll according to Figure 4 in the form of a perspective view from outside.

The figures show a high-pressure roller press 1 that is realized in the form of a material bed roller mill or a compacting machine. It comprises a press frame 2 and two press rollers 3, 4 that are driven in the direction indicated by the arrows and mounted in the press frame. A region that narrows in a funnel-shaped manner, namely the so-called filling funnel, is formed between the press rollers. The pressure zone 5 with a nip S arranged at the height of the roller axes X, X' is formed in the lower region of this filling funnel, wherein the gap width W of the nip S is variable during the operation of the roller press 1. This is realized in that one of the press rollers is realized in the form of a fixed roller 3 and the other press roller is realized in the form of a loose roller 4, wherein the loose roller 4 can be adjusted against the fixed roller 3 (in a horizontal plane), e.g. hydraulically, with the aid of force generating means such that the gap width W of the nip S changes within certain limits during the operation of the roller press. The nip S or the gap width W is adjusted automatically along the nip until a certain pressure acts between the rollers. This means that the roller axes X, X' are arranged in a common horizontal plane and oriented parallel to one another in a normal position (at "zero gap"). However, the loose roller 4 can tilt relative to the fixed roller 3 about a vertical axis and therefore in a horizontal plane during the operation of the roller press such that the roller axes X, X' are in fact always arranged at the same height and therefore in one horizontal plane during the operation of the roller press, but may be oriented at a certain angle relative to one another within this plane.

The material is supplied from above by means of a not-shown feeder chute, wherein the material is drawn into the pressure zone due to the oppositely directed rotation of the rollers and comminuted (or compacted) at this location under the influence of the generated milling pressure. The filling funnel formed between the rollers and, in particular, the pressure zone 5 arranged on its lower end are delimited on the roller end faces by delimiting plates 8 that are arranged laterally next to the press rollers 3, 4 and also referred to as the filling funnel delimitations or "cheek plates" in practical applications. These delimiting plates 8 are movably fastened on the press frame 2 and subjected to a force that is exerted, e.g., by springs 9, wherein the applied force acts in the direction of the roller end faces 6. The delimiting plates 8 can be pushed back against the applied force, e.g. against the force of the springs 9, during the operation of the roller press. This is significant because the aforementioned oblique position of the rollers or one roller 4 is intentionally permitted in a roller press of this type.

One individual roll 10 respectively is fastened in the region of each of the two delimiting plates 8 at the height of the nip S and consequently at the height of the roller axes X, X', wherein said roll is mounted so as to be rotatable about its roll axis Y and laterally delimits the nip S. In the exemplary embodiment shown, the rolls 10 are not fastened on the delimiting plates 8, but rather acted upon by a force in the direction against the respective roller end face independently of the delimiting plates such that the roll 10 can be pushed back against the applied force during the operation of the roller press. According to the invention, the delimiting plates 8 can be pushed back against an applied force during the operation of the roller press and the rolls 10 also can be pushed back against an applied force during the operation of the roller press, but independently of one another and, in particular,

under a different application of force. To this end, the rolls 10 are fastened on the press frame 2 in a movable manner and under the application of a force independently of the respective delimiting plates 8. In the exemplary embodiment shown, the respective rolls 10 are rotatably mounted on a roll holder 16, wherein the roll holder is fastened on the press frame 2 in a movable manner and under the application of a force. The figures show that the roll holders 16 in the exemplary embodiment are realized in the form of pivotable roll holders and therefore in the form of rockers 16, which are coupled to the press frame 2 so as to be pivotable about a rotational axis 17. Such a rocker 16 may have two lateral rocker limbs that are respectively connected to the roll bearings 19 on both sides of the roll - as illustrated, for example, in Figures 4 and 5. The lateral delimiting plate 8 is acted upon by the spring devices 9 indicated in Figure 2 whereas the corresponding roll 10 is acted upon by the separate spring device 18, wherein this spring device 18 engages on the roll holder in the exemplary embodiment and therefore exerts a force upon the pivotable roll holder. Figure 2 shows an embodiment, in which the spring 18 supported on the press frame 2 engages in a region between the roll 10 and the rotational axis 17. In a not-shown optional embodiment, however, the spring 18 may also engage on the roll holder at the height of the roll or higher. In the drawings, the springs 9 and the springs 18 are respectively illustrated in a highly simplified manner in the form of mechanical springs, e.g. coil springs. It is preferred to use mechanical springs for the springs 9 acting upon the delimiting plate 8. However, it is preferred to use hydraulic spring devices such as hydraulic cylinders that, however, are not illustrated in the drawings for respectively acting upon the roll 10 or the roll holder. Hydraulic springs such as hydraulic cylinders (or alternatively also pneumatic springs) provide the advantage that the spring force or the spring constant is variably adjustable such that the force exerted by the

spring 18 can be adapted to the respective requirements, e.g. during the installation. It is particularly preferred that the springs 18 for the rolls on the one hand and the springs 9 for the delimiting plates 8 on the other hand are designed and adapted to one another in such a way that the rolls 10 exert a greater pressure upon the material in the filling funnel and consequently upon the milling bed or material bed than the delimiting plates 8. Furthermore, the spring devices naturally may also be connected to the delimiting plates and the rolls with the aid of suitable transmission means such as pushrods or the like. These transmission means are not illustrated in the drawings.

The rolls 10 are - as described above - fastened on the press frame 2 such that they are acted upon by a force independently of the delimiting plates. However, they are positioned in the region of the respective delimiting plate 8 and preferably mounted in a rotatable manner directly behind the respective delimiting plate. To this end, it is advantageous that each delimiting plate has an opening 15, through which the roll 10 arranged directly behind the delimiting plate 8 extends. Although the delimiting plate 8 and the roll 10 therefore are mounted and acted upon by a force independently of one another, they nevertheless form a functional unit during the operation of the roller press. In the exemplary embodiment, each of the two delimiting plates 8 has a front plane 11 that faces the respective roller end face 6 and is oriented parallel to the roller end face 6. In the exemplary embodiment, a material guide pocket 12 is integrated into the respective delimiting plate 8 above the respective roll 10, wherein said material guide pocket is set back in relation to the above-defined front plane 11 such that the roll 10 can be charged with material from above by means of the material guide pocket 12. Consequently, the material guide pocket 12 has a rear wall 13 that is set back in relation to the front plane 11 and at least regionally spaced apart from the front plane,

wherein the rear wall in the exemplary embodiment is realized in a curved manner in the vertical section according to Figure 2, as well as in the top view according to Figure 3. In the preferred exemplary embodiment shown, this material guide pocket 12 therefore is designed in a funnel-shaped manner in a side view or in a perspective view from inside (according to Figure 4), i.e. the material guide pocket has a width B that narrows downward. In addition, the material guide pocket may also have a depth T that decreases downward (see Figure 2). The material is supplied into the region of the two rolls 10 arranged laterally of the nip S from above by means of the material guide pockets 12. The material guide pockets 12 produce a surplus supply of material in the outer regions on the faces of the rollers 3, 4. Since the rear wall 13 of the material guide pocket 12 is set back, the influence of the friction that impedes the material feed is, so to speak, shifted outward from the nip such that a better material inflow takes place at the roller edges and the material is drawn in in an improved manner. The rolls 10 at the same time significantly reduce the friction in the region of the high-pressure zone 5 such that the wear is minimized on the one hand and the material distribution over the gap width is improved on the other hand.

The advantages described in connection with the embodiment according to Figure 4 can also be realized with an embodiment that is not illustrated in detail. In this embodiment, the material guide pocket 12 likewise has a width B that narrows downward. In contrast to the illustration in Figure 2, however, the material guide pocket may have a constant depth T over its height such that the rear wall of the material guide pocket essentially is oriented vertically. Details regarding this embodiment are not illustrated in the figures.

Figure 1 furthermore shows that the upper vertex 10a of the roll 10 is arranged above the roller axes X and X'. The lower vertex 10b of the roll 10 is arranged below the roller axes X and X'. In the exemplary embodiment illustrated in Figure 1, the upper vertex 10a is arranged above the pressure zone 5 whereas the lower vertex 10b is arranged below the pressure zone 5. According to Figure 1, the pressure zone 5 is defined as the zone of the roller press, which extends between the two rollers over a circumferential angle α of -5° to $+15^\circ$, namely referred to the straight connecting line through the roller axes X, X'. According to this definition, the pressure zone 5 consequently is the region that lies between $+15^\circ$ above the roller axis and -5° below the roller axis X, X'. In the exemplary embodiment, the roll axis Y of the rolls 10 lies at the height or approximately at the height of the roller axes X, X' of the press rollers 3, 4. In this context, it should be noted that the diameters of the press rollers 3, 4 on the one hand and the diameters of the rolls 10 on the other hand are not illustrated true-to-scale.

In any case, the width E of the rolls 10 is greater than the maximum gap width W and consequently greater than the zero gap of the nip S plus at least the distance, by which the nip opens due to the horizontal movement of the loose roller 4 during the operation of the machine. In this context, the width E or roll width refers to the width of the roll body, i.e. the width of the working surface of the rolls.

The roller circumference and consequently the circumferential surface 7 of the press rollers 3, 4 typically is provided with a special surface quality, e.g. with a wear-resistant coating or lining. Details regarding this aspect are not illustrated in the figures. In a preferred embodiment, the roll circumference and consequently the circumferential surface or roll body

surface 14 of the rolls 10 may also be provided with a wear-resistant coating. Consequently, the circumferential surfaces 14 of the rolls 10 respectively may be realized in a wear-armored manner or have a wear armor. Conventional measures for armoring the roller surfaces against wear can be used for this wear armor of the rolls 10. For example, a plurality of studs may be integrated into the circumferential surface in a nub-like manner (stud lining). Alternatively, a wear armor can be realized with a plurality of tile-like wear elements that are fastened on the surface. A wear armor produced by means of buildup welding may furthermore be considered. The roll itself preferably is always made of steel and the wear armor of a hard, wear-resistant material is arranged on the circumference of this roll. The circumferential surface 14 of the rolls may optionally or additionally be provided with a profiling or structuring. Details regarding this aspect are not illustrated in the figures. It is furthermore possible that the rolls 10 are respectively driven by a drive. Such a drive is not illustrated in the figures. Furthermore, guide installations for guiding the material onto the roll 10 may be integrated into the material guide pockets 12, but such guide installations likewise are not illustrated in the figures. However, Figure 4 schematically shows that the delimiting plates 8 may be respectively provided with one or with multiple additional sealing plates 20, wherein said sealing plates respectively extend, for example, parallel to the front plane 11 or in the front plane 11 and partially cover the material guide pocket 12 on the front side. This makes it possible to optimize the supply of the material into the region of the roll 10 and into the region of the high-pressure zone 5.

Figures 4 and 5 show that the delimiting plates 8 respectively have an opening 15, through which the rotatable roll 10 mounted behind the delimiting plate 8

extends, namely into a region underneath the material guide pocket 12. Consequently, the rolls 10 are mounted on the rear side of the delimiting plates 8 so as to be rotatable about an axis Y.

The roll 10 or its roll body therefore is arranged in a pocket-like indentation 12' of the delimiting plate, which is arranged underneath the material guide pocket 12, i.e. the underside of the funnel-shaped material guide pocket 12 leads into the indentation 12' or the opening 15 for the roll 10. The roll 10 or its roll body extends through the opening 15.

Furthermore, it is optionally also possible to equip the delimiting plates, e.g. their front plane 11, and the material guide pockets 12 with a wear armor. The delimiting plates may be made, for example, of steel and a wear armor may be arranged on the respective surfaces.

Patentkrav

1. Højtryksvalsepresse (1), især højtryksvalseværk eller komprimeringsma-
skine, med to pressevalser (3, 4), der er drejeligt monteret i en presseramme
5 (2), og mellem hvilke der er dannet en påfyldningstragt med en valsepalte
(S), der er anbragt i højden af valseaksen (X, X'), og hvis spaltebredde (W) er
variabel under driften af valsepressen (1),

hvor påfyldningstragten mellem pressevalserne (3, 4) er afgrænset ved val-
sens endeflader af afgrænsningsplader (8), der er anbragt sideværts ved siden
10 af pressevalserne (3, 4), og

hvor afgrænsningspladerne (8) er fastgjort på presserammen (2) på en bevæ-
gelig måde og under påvirkning af en kraft på en sådan måde, at afgræns-
ningspladerne (8) kan skubbes tilbage mod den påførte kraft under driften af
valsepressen (1),

15 **kendetegnet ved,**

at der ved siden af hver af pressevalserne (3, 4) i højden af valsepalten (S)
er anbragt en enkelt rulle (10), som er drejeligt monteret om sin valseakse (Y),
og som afgrænser valsepalten (S) sideværts, hvor rullerne (10) hver især er
bevægelige i forhold til afgrænsningspladen (8), og hver især er kraftbelastet i
20 retning mod den respektive valseendeflade på en sådan måde, at rullerne (10)
kan presses tilbage mod kraftbelastningen under drift af valsepressen (1).

2. Valsepresse ifølge krav 1, **kendetegnet ved, at** rullerne (10) er fastgjort på
presserammen (2) på en bevægelig måde og under påføring af en kraft uaf-
25 hængigt af de respektive afgrænsningsplader (8).

3. Valsepresse ifølge krav 1 eller 2, **kendetegnet ved, at** rullerne (10) hver
især er drejeligt monteret i eller på mindst én rulleholder, som er fastgjort på
presserammen (2) på en bevægelig måde og under påvirkning af en kraft.

4. Valsepresse ifølge krav 3, **kendetegnet ved, at** rulleholderen er udført i form af en vippe (16), som er koblet til presserammen (12), således at den kan drejes om en rotationsakse (17).
- 5 **5.** Valsepresse ifølge et af kravene 1 til 4, **kendetegnet ved, at** rullerne (10) eller den respektive rulleholder påvirkes af en kraft, der genereres af mindst én respektive fjederindretning (18), som er understøttet, for eksempel på presserammen (2) og virker mod respektive rulle (10) eller rulleholderen.
- 10 **6.** Valsepresse ifølge krav 5, **kendetegnet ved, at** fjederindretningen (18) er udformet som en mekanisk, hydraulisk eller pneumatisk fjederindretning, der fortrinsvis har en indstillelig fjederkraft, f.eks. en styrbar eller justerbar fjederkraft.
- 15 **7.** Valsepresse ifølge et af kravene 1 til 6, **kendetegnet ved, at** rullerne (10) på den ene side og afgrænsningspladerne (8) på den anden side er kraftbelastede med fjederindretninger (18, 9) på en sådan måde, at rullerne (10) udøver et større tryk på materiale end afgrænsningspladerne (8) .
- 20 **8.** Valsepresse ifølge et af kravene 1 til 7, hvor en af pressevalserne (3) er udført i form af en fast valse (3), og en af pressevalserne (4) er udført i form af en løs valse (4), der er bevægelig i forhold til den faste valse (3), og hvor den løse valse (4) kan justeres mod den faste valse (3) ved hjælp af kraftgenererende midler, f.eks. hydraulisk, med en spaltebredde (W), der varierer under drift.
- 25
- 30 **9.** Valsepresse ifølge et af kravene 1 til 8, hvor afgrænsningspladerne hver især har et frontplan (11), der vender mod den respektive valseendeflade (6) og er orienteret parallelt med valseendefladen (6), **kendetegnet ved, at** en materialestyrelomme (12), som er sat tilbage i forhold til frontplanet (11), er integreret i afgrænsningspladen (8), f.eks. over rullen (10), der er knyttet til den

respektive afgrænsningsplade, materiale kan påføres rullen (10) ovenfra via materialestyringslommen (12).

5 **10.** Valsepresse ifølge krav 9, **kendetegnet ved, at** materialestyrelommen (12) i et sidebillede er realiseret på en tragtformet måde med en bredde (B), der indsnævres nedad, og/eller at materialestyrelommen (12) har en dybde (T), der aftager nedad.

10 **11.** Valsepresse ifølge et af kravene 1 til 10, **kendetegnet ved, at** den øverste spids (10a) af rullen (10) er anbragt over valseaksen (X, X'), og/eller at den nederste spids (10b) af rullen (10) er anbragt under valseaksen (X, X').

15 **12.** Valsepresse ifølge et af kravene 1 til 11, **kendetegnet ved, at** den øverste spids (10a) af rullen (10) er anbragt over trykzonen (5), og/eller at den nederste spids (10b) af rullen (10) er anbragt under trykzonen (5).

13. Valsepresse ifølge et af kravene 1 til 12, **kendetegnet ved, at** rulleaksen (y) af rullen (10) er henholdsvis anbragt i højden af valseaksen eller i højden af valseakserne af valserne.

20 **14.** Valsepresse ifølge et af kravene 1 til 13, **kendetegnet ved, at** diameteren (D) af rullen (10) eller rullerne udgør mindst 5%, fortrinsvis mindst 10%, af valse-diameteren, f.eks. ca. 5% til 35%, fortrinsvis 10% til 30%, af valse-diameteren (M), og/eller at diameteren (D) af rullen (10) eller rullerne udgør mindst 50
25 mm, fortrinsvis mindst 100 mm, f.eks. 50 mm til 1000 mm, fortrinsvis 100 mm til 600 mm.

15. Valsepresse ifølge et af kravene 1 til 14, **kendetegnet ved, at** bredden (E) af rullen er større end den maksimale spaltebredde (W) af valsepalten (S),
30 og/eller at bredden af rullen eller rullerne udgør ca. 1% til 10%, f.eks. 2% til 8% af valse-diameteren, og/eller at bredden (E) af rullen (10) eller rullerne udgør

mindst 50 mm, f.eks. 50 mm til 200 mm.

5 **16.** Valsepresse ifølge et af kravene 1 til 15, **kendetegnet ved, at** rullen har en profileret eller struktureret overflade på sin rulleomkreds (14), og/eller at rullen (10) er forsynet med en slidpanser på sin rulleomkreds (14).

10 **17.** Valsepresse ifølge et af kravene 1 til 16, **kendetegnet ved, at** afgrænsningspladerne (8) hver især har en åbning (15), gennem hvilken rullen (10), som er drejeligt monteret, for eksempel på bagsiden bag afgrænsningspladen (8), når igennem, for eksempel ind i området af materialestyrelommen (12) eller ind i et område under materialestyrelommen (12).

15 **18.** Valsepresse ifølge et af kravene 1 til 17, **kendetegnet ved, at** rullen (10) drives uden eget drev via materialet eller via de drevne valser, f.eks. ved at trykke den respektive rulle (10) mod endefladerne (6) af valserne (3, 4).

19. Valsepresse ifølge et af kravene 1 til 17, **kendetegnet ved, at** rullen (10) drives af et drev.

20 **20.** Valsepresse ifølge et af kravene 1 til 19, **kendetegnet ved, at** en eller flere føringsinstallationer til føring af materialet på rullen (10) er integreret i enhver af materialestyrelommerne (12).

25 **21.** Valsepresse ifølge et af kravene 1 til 20, **kendetegnet ved, at** afgrænsningspladerne (8) hver især er forsynet med en eller flere yderligere tætningsplader (17), som for eksempel løber parallelt med frontplanet (11) eller i frontplanet (11) og delvist dækker materialestyrelommen (12) på forsiden.

Fig. 2

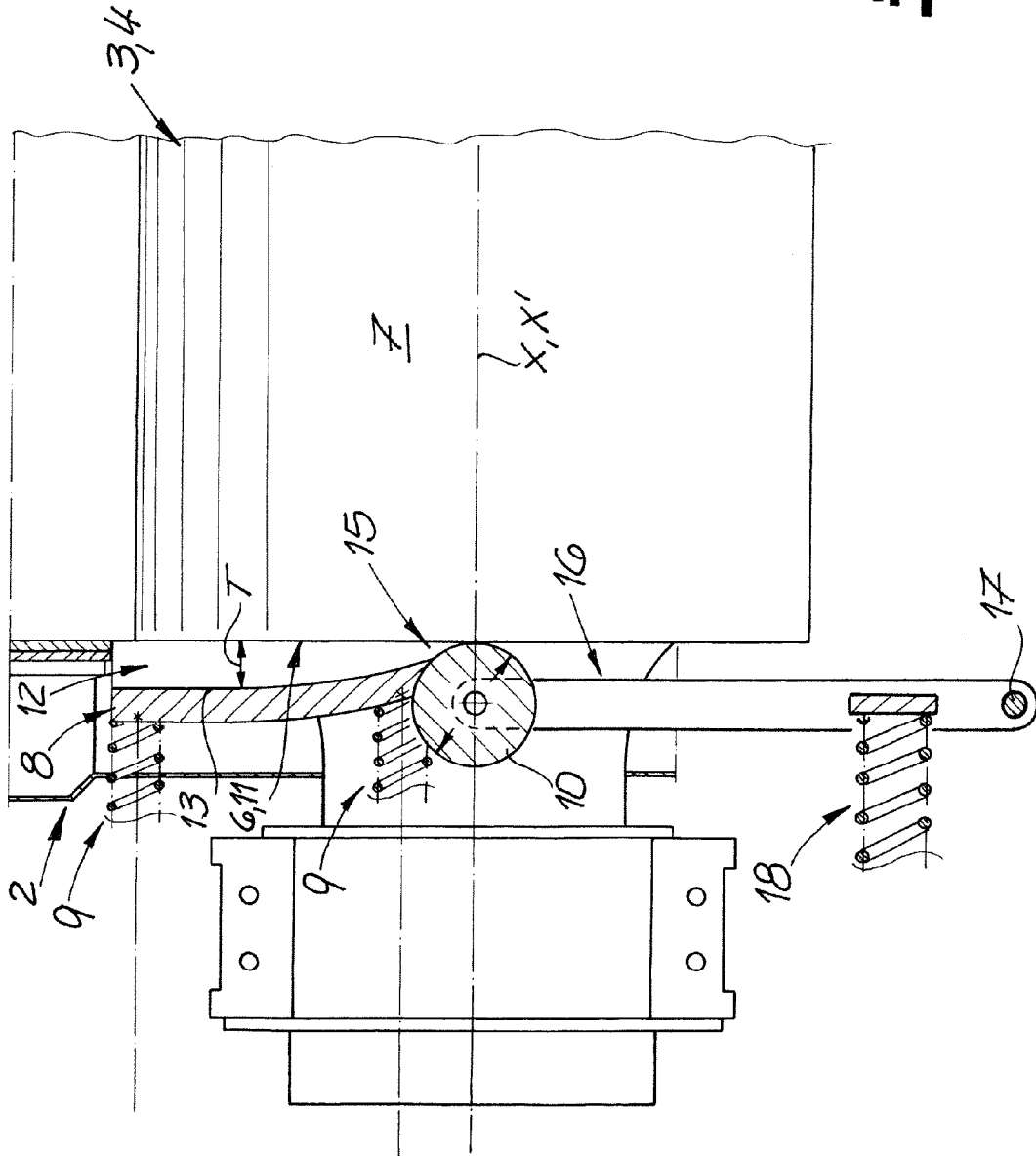
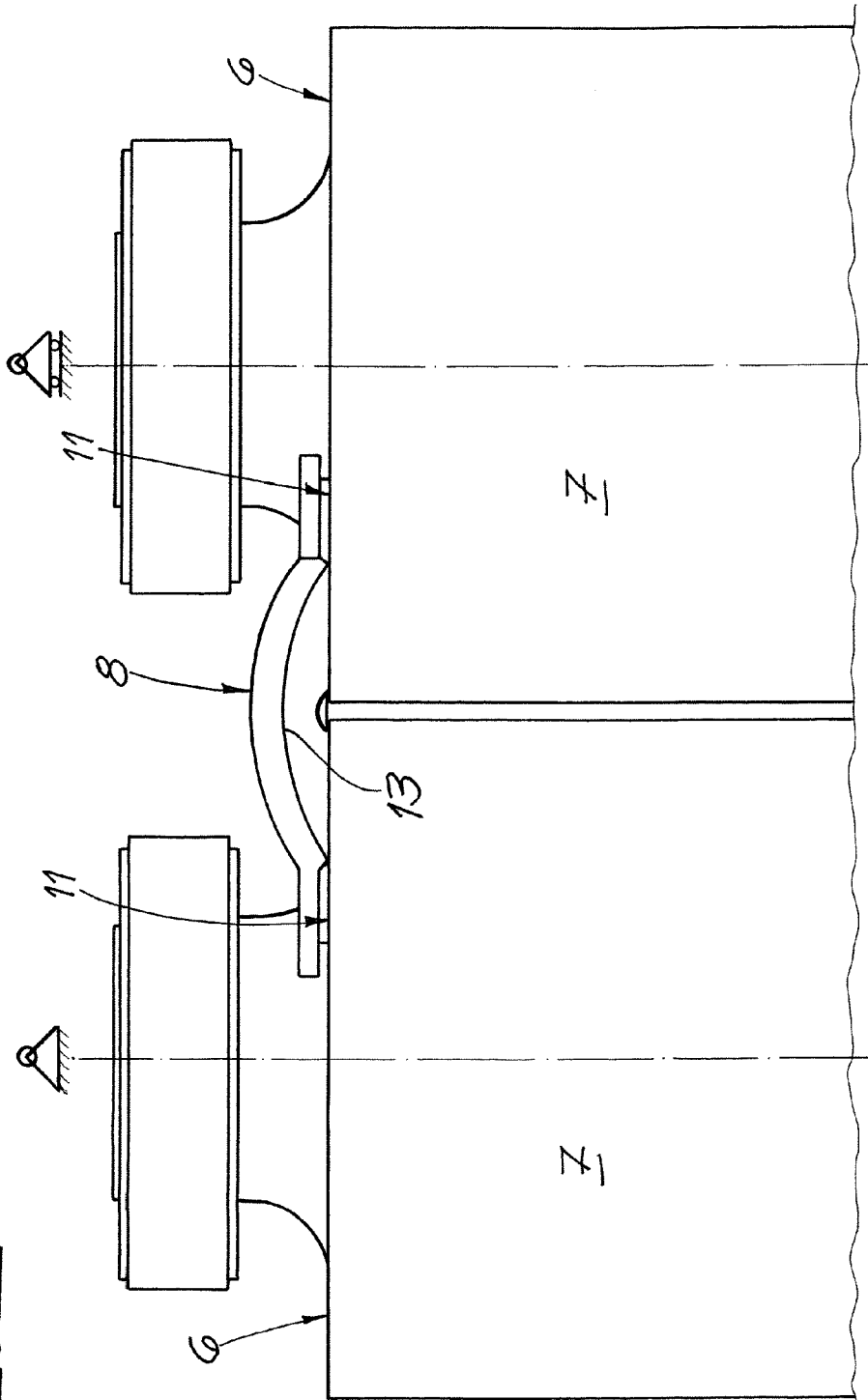


Fig. 3



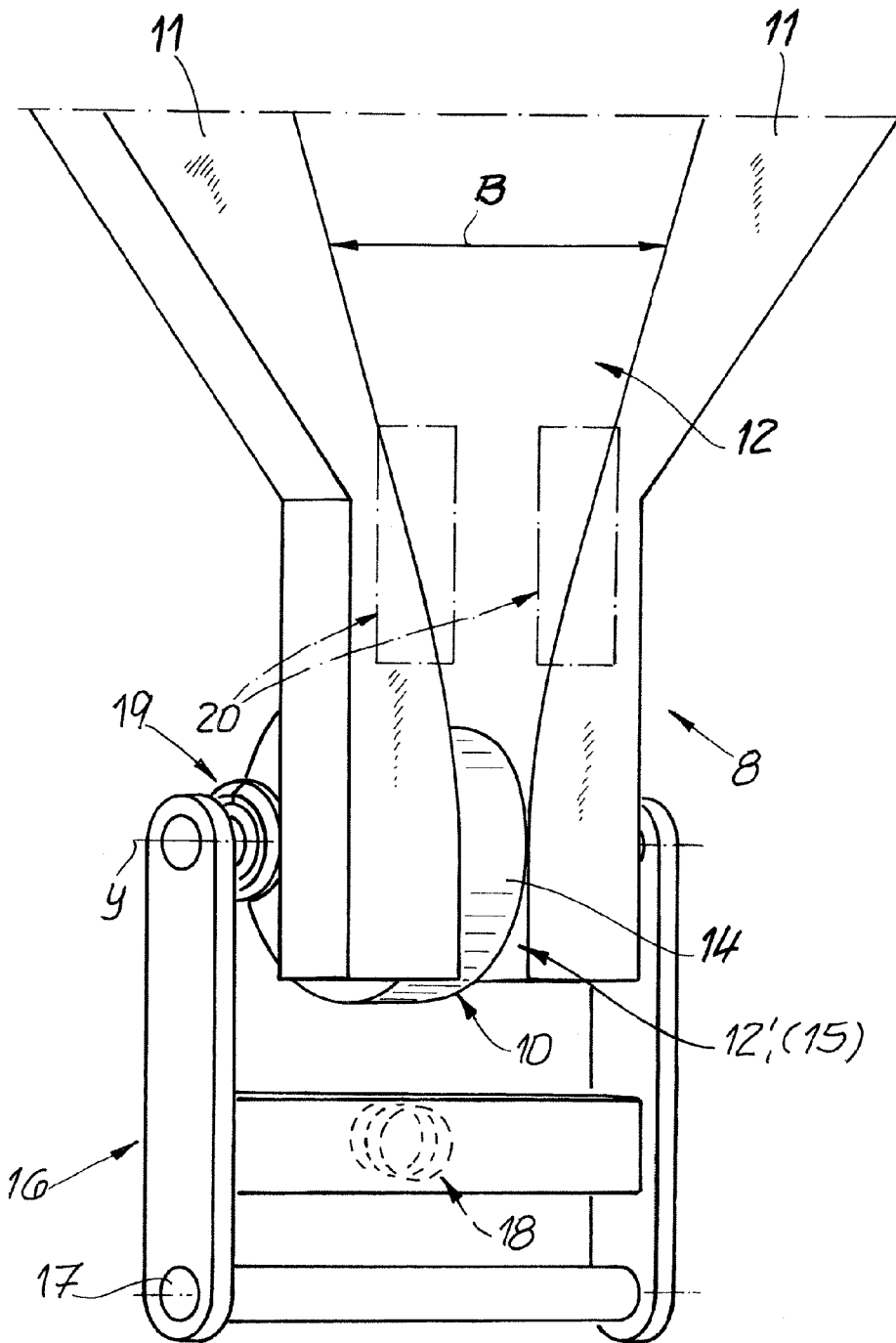
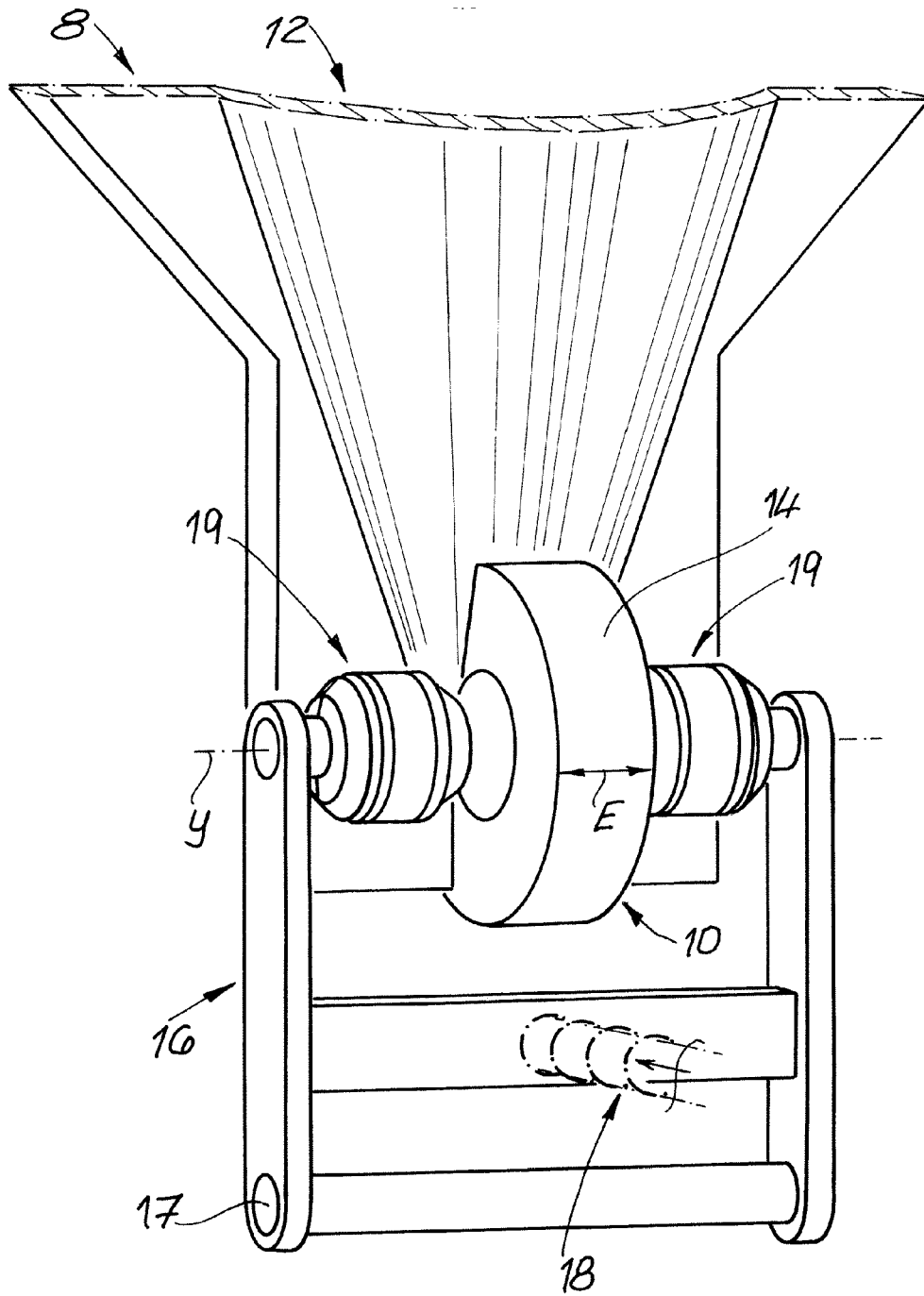


Fig. 4

**Fig. 5**