(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 759 831 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.03.2007 Bulletin 2007/10

(51) Int Cl.:
B30B 9/18 *(2006.01)* ***B30B 9/12*** *(2006.01)*

(21) Application number: **05077011.4**

(22) Date of filing: **02.09.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(71) Applicant: **Sorensen, Preben S.**
9620 Alestrup (DK)

(72) Inventor: **Sorensen, Preben S.**
9620 Alestrup (DK)

(74) Representative: **Schmidt, Jens Joergen et al**
Patentgruppen ApS,
Arosgaarden,
Aaboulevarden 31
8000 Aarhus C (DK)

(54) Screw press

(57) A multi purpose screw press (1) is disclosed for separating materials with a composition of liquid and solid matter into a substantially solid part and a substantially liquid part.

The cross-sectional diameter of at least a section of the shaft (12) of the screw is substantially increasing in the longitudinal direction from the feeder to a solid matter outlet end (6) of the cylinder, and the press has means for changing the mutual longitudinal position of the solid matter outlet end of the cylindrical portion and the section of the screw conveyor where the cross-sectional diameter of the shaft (12) is substantially increasing, thereby changing the area between the shaft and the solid matter outlet (6) and thus the total compression of the substance.

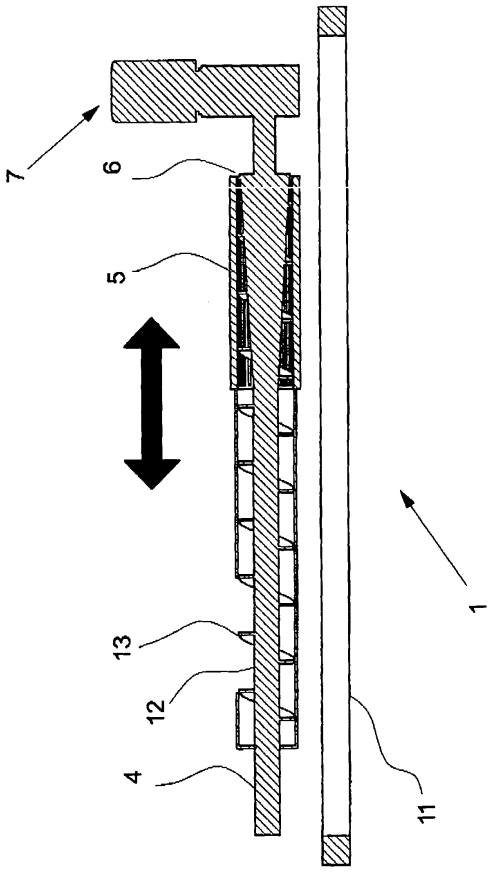

Fig. 3

EP 1 759 831 A1

Description

FIELD OF INVENTION

[0001] The present invention relates to a multi purpose screw press for separating a large variety of materials with a composition of liquid and solid matter into a substantially solid part and a substantially liquid part.

BACKGROUND

[0002] Screw presses are used to process a large variety of materials by separating them into a solid part and a liquid part respectively. The applications of screw presses ranges from pressing oil from seeds or juice from fruits and vegetables over dewatering of wastewater sludge and liquid manure to compacting or pressing biomass from industrial and household waste.

[0003] The different types of materials used usually require different types of screw presses. For some materials e.g. oilseeds it is desirable to be able to change the screw press total compression ratio during the pressing process in order to maintain a high quality of the oil. Further some types of materials are likely to stick to the screw conveyer or even clog the press, so it is also very desirable to provide a screw press with mechanisms for ensuring a continuous flow of material and unclogging of the press.

[0004] The international patent application WO 98/37942 discloses a device for separating a substance into solid matter and liquid matter. The device comprises a cylindrical press basket enclosing a screw conveyer having a conical shaft section and a cylindrical shaft section at the outlet end of the press basket. The maximum force exerted on the substance is regulated by moving the press basket relatively to the screw conveyer in the longitudinal direction, so as to vary the size of an outlet opening between a plate mounted on the screw conveyor and a plate mounted at the outlet end of the press basket, the plates being parallel and arranged perpendicularly to the longitudinal direction of the screw conveyor. The total compression ratio of the substance is kept constant through the device because the outlet end of the press basket is displaced along the part of the screw conveyor having a cylindrical shaft.

[0005] US 6,505,550 disclose a waste compaction apparatus having a screw conveyer which conveys material along a passage towards a funnel-shaped exit-nozzle. The screw conveyer is biased in the axial direction allowing avoiding or removing blockages in the apparatus during compacting.

[0006] When designing a screw press for a variety of purposes, the different characteristics of the different materials can cause problems for the operation of the press and the quality of the output. Many materials like industrial and household waste usually have varying composition of liquid and solid matter together with a content of larger rigid particles. Materials with these properties tend to create an uneven flow through the press an even in some cases completely clog the press. Other materials like oilseed require a press with a variable compression ratio in order to obtain a high quality of the separated oil. It is thus an object of the present invention to provide a screw press adaptable for separating a large variety of materials into a substantially solid part and a substantially liquid part. A second object of the present invention is to provide a screw press with means for continuously adapting the properties of the screw press in order to optimize the quality of the output from the screw press. Further it is an object of the present invention to ensure a continuous flow material through the screw press and to relieving or prevent clogging of the press.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

[0007] The screw press according to the present invention comprises a feeder for supplying the press with a substance, a cylindrical portion extending in a longitudinal direction of the press from said feeder to a solid matter outlet end, a liquid outlet comprising one or more cylindrical press baskets arranged along the cylindrical portion of the press, a screw conveyer arranged within a cylindrical cavity of the cylindrical portion and comprising a screw blade fastened on a shaft, wherein the cross-sectional diameter of at least a section of said shaft is substantially increasing in the longitudinal direction from the feeder to the solid matter outlet end, a drive unit comprising means for rotating said screw conveyer, and means for changing the mutual longitudinal position of the solid matter outlet end of the cylindrical portion and the section of the screw conveyor wherein the cross-sectional diameter of the shaft is substantially increasing, thereby changing the area between the shaft and the solid matter outlet and thus the total compression of the substance.

[0008] With the term substantially increasing is understood that the diameter of the shaft is increased with a substantial quantity, such as e.g. with 35% or more, such as with 75% or more. However, the increment is not necessarily constant, as shown in the embodiments discussed below, or even smooth and continuous, but could alternatively be step wise or following a parabolic or a hyperbolic curve.

[0009] To prevent a stand-still of the flow of substance through the cylindrical portion, the screw press further comprises means for guiding the substance through the screw press by reducing or preventing rotation of the substance within the cylindrical portion. The guide means could be at least one toothed guide wheel arranged rotational in a housing orthogonal to the cylindrical portion of the screw press and the teeth engaging the screw conveyer blade, or the guide means could be least one guide stick inserted through one of the apertures of the press baskets.

[0010] In order to optimize the quality of the liquid and solid output and to prevent damage to the components

of the press, the screw press according to the present invention may further comprise control means for controlling the operation of the screw press including the means for changing the mutual longitudinal position of the solid matter outlet end of the cylindrical portion and the section of the screw conveyor wherein the cross-sectional diameter of the shaft is substantially increasing.

[0011] When controlling the operation of the screw press it is advantageous to determine the instantaneous total compression of the substance. Therefore the screw press according to the present invention may advantageously comprise position determining means for determining the position of the screw conveyer relative to the position of the cylindrical portion of the screw press and providing an output accordingly to the control means.

[0012] The quality of the liquid and solid output depends in some cases on the physical properties of the compressed substance in the cylindrical portion of the screw press. Therefore the screw press may further comprise sensor means for measuring at least one physical property of the substance in the screw press and providing an output accordingly to the control means. The physical properties measured could e.g. be the temperature, moisture or the pressure of the substance.

[0013] The operation of the screw press also depends of the electrical and mechanical parameters of the screw press components. The electrical parameter of the drive unit such as power consumption represents the loading of the screw conveyer. In order to detect e.g. an overload of the screw conveyer, the screw press may comprise means for measuring at least one electrical property of said drive unit.

[0014] An overload of the screw conveyer could also be represented by mechanical parameters such as torque and/or rotational speed of the screw conveyer. The screw press according to the present invention may further comprise means for measuring the torque of the screw conveyer and/or means for measuring the rotational speed of the screw conveyer.

[0015] Thus, the present invention offers many ways of optimizing the operation of the screw press with regards to a high quality output and safe operation of the press wherein the operation of said screw press may be controlled accordingly to the outputs provided by said position determining means, said sensor means, said means for measuring at least one electrical property of the drive unit, said means for measuring the torque of the screw conveyer and/or said means for measuring the rotational speed of the screw conveyer.

[0016] The press baskets of the screw press according to one preferred embodiment have an inner diameter between 100 and 1000 mm preferably between 150 and 750 mm, and may be made from a pipe having a thickness between 10 and 100 mm preferably between 20 and 50 mm. The form and method of producing of the press baskets depend on the type of substance used in each screw press. Therefore other press baskets made with different dimensions and made of other materials, e.g. a sheet of metal or a plastic pipe, than the above described, is also within the disclosure of the present invention.

[0017] In one preferred embodiment of the screw conveyer, the diameter of at least one section of the shaft of said screw conveyer increases between 0.5° and 8.0° preferably between 1.5° and 5.0° in the longitudinal direction from the feeder end to the solid matter outlet end of the screw press. The increase in diameter is not necessarily constant but may vary smoothly or in steps. Further the pitch of the screw conveyer is between 0.5 and 2, defined as the ratio between the longitudinal extend of one rotation of the screw blade and the outer diameter of the screw blade.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Fig. 1 shows a preferred embodiment of the present invention,

Fig. 2 shows the drive unit and a spindle drive for moving the screw conveyer in the longitudinal direction of a screw press according to a preferred embodiment of the present invention,

Fig. 3 shows a cross sectional view of a screw press according to the present invention,

Fig. 4 shows the feeder of a screw press according to a preferred embodiment of the present invention,

Fig. 5 shows the press baskets of a screw press according to a preferred embodiment of the present invention, and

Fig. 6 shows a cross sectional view of the press baskets of a screw press according a preferred embodiment of the present invention, the figure further shows a section of the screw conveyer and a guide wheel according to a preferred embodiment.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

[0019] A screw press 1 according to a preferred embodiment of the present invention is shown in Fig. 1. A substance comprising both solid and liquid matter enters the screw press 1 through a feeder 2 which is placed around an opening of a cylindrical portion 3 of the screw press 1. Inside the screw press 1 a double-threaded screw conveyer 4 (shown in Fig. 3) moves the substance in the longitudinal direction past a plurality of press baskets 5, placed along the cylindrical portion 3 of the screw press 1, wherein liquid matter is separated from the substance and collected by a first vessel (not shown). A second vessel (also not shown) collects the solid matter of the substance which is let out by an annular solid matter

outlet 6 at the end of the press baskets 5 opposite to the feeder end of the screw press 1. The screw conveyer 4 inside the press is rotated by a movable drive unit 7 which may be moved in the longitudinal direction by a spindle drive 8. A housing 9 encapsulates a first toothed guide wheel 10 (shown in Fig. 6) which guides the substance forward through the press and prevents a stand-still of the substance within the cylindrical portion. In this specific embodiment, the screw conveyer 4 is double-threaded which requires a second tooth guide wheel placed in a similar manner on the opposite side of the cylindrical portion 3. A frame 11 supports the cylindrical portion 3, the press baskets 5, the drive unit 7 and the spindle drive 8. The annular solid matter outlet 6, the screw conveyer 4 and the first toothed guide wheel 10 will be shown in detail and explained later.

[0020] Fig. 2 shows the drive unit 7 of the screw press 1 in detail. In a preferred embodiment the drive unit 7 comprises an electric motor 7a vertically mounted on top of a gear unit 7b connected to the screw conveyer 4. The mounting of the drive unit 7 and the spindle drive 8 allows the drive unit 7 and thus the screw conveyer 4 to be moved in the longitudinal direction. In an alternative embodiment of the present invention, the spindle drive 8 could be replaced with a hydraulic piston. The drive unit 7 of the present invention is arranged to drive the screw conveyer 4 with a rotation speed in the range of 7 to 20 rotations per minute.

[0021] The cross sectional drawing in Fig. 3 shows the principle of the screw press 1 according to a preferred embodiment of the present invention in the ordinary operating position. The screw conveyer 4 comprises a shaft 12 and a double-threaded cylindrical screw blade 13. The shaft 12 has a first section wherein the diameter of the shaft is constant, in the shown embodiment 90 millimetres, and a second section, wherein the diameter of the shaft is substantially increasing with a slope of 3.8° and extend for about 750 millimetres, so that the diameter of the shaft at the end of its conical part is 190 millimetres. The inner diameter of the cylindrical portion 3 is 200 millimetres. Initially, the first section of the shaft 12 extends the entire length of the closed cylindrical portion 3 of the screw press 1, and the second section of the shaft 12 extents from the entrance of the press baskets 5, and to the annular solid matter outlet 6.

[0022] When the drive unit 7 and thus the screw conveyer 4 are moved in the longitudinal direction by the spindle drive 8, the area of the annular solid matter outlet 6 is changed and thus the total compression ratio of the substance. The total compression ratio of the substance can be controlled by control means deriving a control input to the spindle drive 8 according to inputs form one or more sensors measuring different physical parameters of substance or electrical or mechanical parameters of the drive unit 7. Some of the parameters measured could be the temperature of the substance representing the actual compression of the substance or the parameters could be the power consumption of an electrical motor of the drive unit 7 representing the actual torque of the screw conveyer 4. These measurements can be used to control the quality of the liquid and solid output form the screw press 1 or to prevent damage to the screw press 1 in case rigid objects should clog the screw press 1. Thus, the longitudinal position of the screw conveyor 4 may be adjusted under operation of the screw press 1 in response to operational parameters of the press 1. The movable drive unit 7 and screw conveyer 4 also allows for removing clogs and easy maintenance of the screw conveyer 4 simply by substantially completely moving the second section of the screw conveyer 4 out of the press baskets 5. The present embodiment allows for a maximal displacement of the screw conveyer 4 of 600 millimetres out of a total length of the second section thereof of 750 millimetres, which normally will be sufficient to remove clogs from the screw conveyer 4.

[0023] Fig. 4 shows the feeder 2 mounted around an opening in the closed cylindrical portion 3 of the screw press 1. The form of the feeder 2 is not limited to the form shown in the drawings, but is adapted to the primary use of each individual screw press 1. As an example if the screw press 1 is used for dewatering of wastewater sludge or liquid manure, the feeder 2 could be replaced by a hose.

[0024] A detailed drawing of the press baskets 5 is shown in Fig. 5 in a preferred embodiment of the present invention, the press baskets 5 are made from a pipe with an internal diameter of 200 mm and a thickness of 25 mm. Apertures are milled in the side of the pipe having a with of 10 mm on the outside and 1.5 mm on the inside of the pipe and a length of 250 mm. The form of the press baskets 5 is not limited to the embodiment shown in fig. 5 and the description above. Like the feeder 2, the press baskets can be custom made to the specific use of each individual screw press 1 optimized with respect to parameters like price, maximum pressure inside the press baskets 5 and the physical nature of the substance. Alternative methods of constructing the press baskets could be an apertured sheet of metal or plastic formed to a cylinder or a plurality of metal rods inserted between two or more rings in a squirrel cage like configuration. The screw blades 13 are manufactured to fit closely to the cylindrical inner wall of the cylindrical portion 3 and in particular to the cylindrical inner wall of the press baskets 5. The clearance between the outer rim of the screw blades 13 and the inner wall of the press baskets 5 is in the order of 0.1 to 0.4 millimetres in order to prevent clogging of the apertures of the press baskets 5.

[0025] Fig. 6 shows the interior of the press baskets 5. The annular solid matter outlet 6 has an annular formed area between the screw conveyer 4 and the interior of the outer edge of the press baskets 5. When the screw conveyer 4 is moved relative to the press baskets 5, the area of the solid matter outlet is changed and thus the total compression ratio of the substance. The highest total compression ratio is achieved when the screw conveyer 4 is moved all the way towards the feeder end of

the screw press, thus having the smallest possible annular area between the interior of the press baskets and the screw conveyer. When a lower total compression is desired the drive unit 7 and thus the screw conveyer 4 is moved in the opposite direction of the feeder end of the screw conveyer 1 by the spindle drive 8. The lowest possible total compression ratio of the substance is determined by the length of the second section of the screw conveyer 4, wherein the diameter of the shaft 12 is substantially increasing or by the highest allowable longitudinal travel distance of the screw conveyer 4.

[0026] The first toothed guide wheel 10 engages the first section of the screw conveyer, wherein the diameter of the shaft 12 is constant, and ensures that the substance is pushed forward through cylindrical portion 3 and the press baskets 5 towards the annular solid matter outlet 6. In this specific embodiment, wherein the screw conveyer 4 is double-threaded, a second toothed guide wheel is required placed in a similar manner on the opposite side of the cylindrical portion 3 of the screw press 1. The shape of the toothed guide wheels can be adapted to fit the individual type of substance used in the screw press 1. A substance with a high content of liquid matter like tomatoes requires guide wheels with a close fitting between the outer edge of the teeth and screw blade 13 and the shaft 12 in order to maintain a flow through the screw press 1. Other types of substances with a varying content of soft and hard rigid objects like ordinary household garbage requires guide wheels, wherein the distance between the outer edge of the teeth and the shaft 12 is substantially larger than guide wheels for pressing tomatoes in order to prevent stand-still of the screw conveyer 4.

[0027] In order to accommodate the guide wheel 10, the pitch of the screw blade 13 along the distance of the screw conveyor 4 with which the guide wheel 10 will engage during operation of the screw press 1 should be constant. In one preferred embodiment, the pitch is constant throughout the length of the screw conveyor, but the pitch may increase of decrease towards the outlet end, depending on the intended use of the screw press 1.

[0028] The toothed guide wheels can be left out, e.g. if the substances are highly fluid and pressure fed to the feeder of the screw press 1.

Claims

1. A screw press comprising:

a feeder for supplying the press with a substance,
a cylindrical portion extending in a longitudinal direction of the press from said feeder to a solid matter outlet end,
a liquid outlet comprising one or more cylindrical press baskets arranged along the cylindrical portion of the press,
a screw conveyer arranged within a cylindrical cavity of the cylindrical portion and comprising a screw blade fastened on a shaft, wherein the cross-sectional diameter of at least a section of said shaft is substantially increasing in the longitudinal direction from the feeder to the solid matter outlet end,
a drive unit comprising means for rotating said screw conveyer, and
means for changing the mutual longitudinal position of the solid matter outlet end of the cylindrical portion and the section of the screw conveyor wherein the cross-sectional diameter of the shaft is substantially increasing, thereby changing the area between the shaft and the solid matter outlet and thus the total compression of the substance.

2. A screw press according to claim 1 comprising means for reducing rotation of the substance flowing through the screw press.

3. A screw press according to claim 2, wherein said means comprises at least one toothed guide wheel arranged rotational in a housing orthogonal to the cylindrical portion of the screw press and the teeth engaging the screw conveyer blade.

4. A screw press according to claim 2 or 3, wherein said means comprises at least one guide stick inserted through one of the apertures of the press baskets.

5. A screw press according to any of the preceding claims comprising control means for controlling the operation of the screw press including the means for changing the mutual longitudinal position of the solid matter outlet end of the cylindrical portion and the section of the screw conveyor wherein the cross-sectional diameter of the shaft is substantially increasing.

6. A screw press according to claim 5 comprising position determining means for determining the position of the screw conveyer relative to the position of the cylindrical portion of the screw press and providing an output accordingly to the control means.

7. A screw press according to claim 5 or 6 comprising sensor means for measuring at least one physical property of the substance in the screw press and providing an output accordingly to the control means.

8. A screw press according to claim 5, 6 or 7 comprising means for measuring at least one electrical property of said drive unit and providing an output accordingly to the control means.

9. A screw press according to claim 5, 6, 7 or 8 comprising means for measuring the torque of the screw conveyer and providing an output accordingly to the control means.

10. A screw press according to claim 5, 6, 7, 8 or 9 comprising means for measuring the rotational speed of the screw conveyer and providing an output accordingly to the control means.

11. A screw press according to any of claims 5, 6, 7, 8, 9 or 10, wherein the operation of said screw press is controlled accordingly to the outputs provided.

12. A screw press according to any of the preceding claims, wherein the press baskets have an inner diameter between 100 and 1000 mm, preferably between 150 and 750 mm.

13. A screw press according to any of the preceding claims, wherein the press baskets are made from a pipe having a thickness between 10 and 100 mm, preferably between 20 and 50 mm.

14. A screw press according to any of the preceding claims, wherein the diameter of at least one section of the shaft of said screw conveyer increases between 0.5° and 8.0° preferably between 1.5° and 5.0° in the longitudinal direction from the feeder end to the solid matter outlet end of the screw press.

15. A screw press according to any of the preceding claims, wherein the pitch of the screw conveyer is between 0.5 and 2, defined as the ratio between the longitudinal extend of one rotation of the screw blade and the outer diameter of the screw blade.

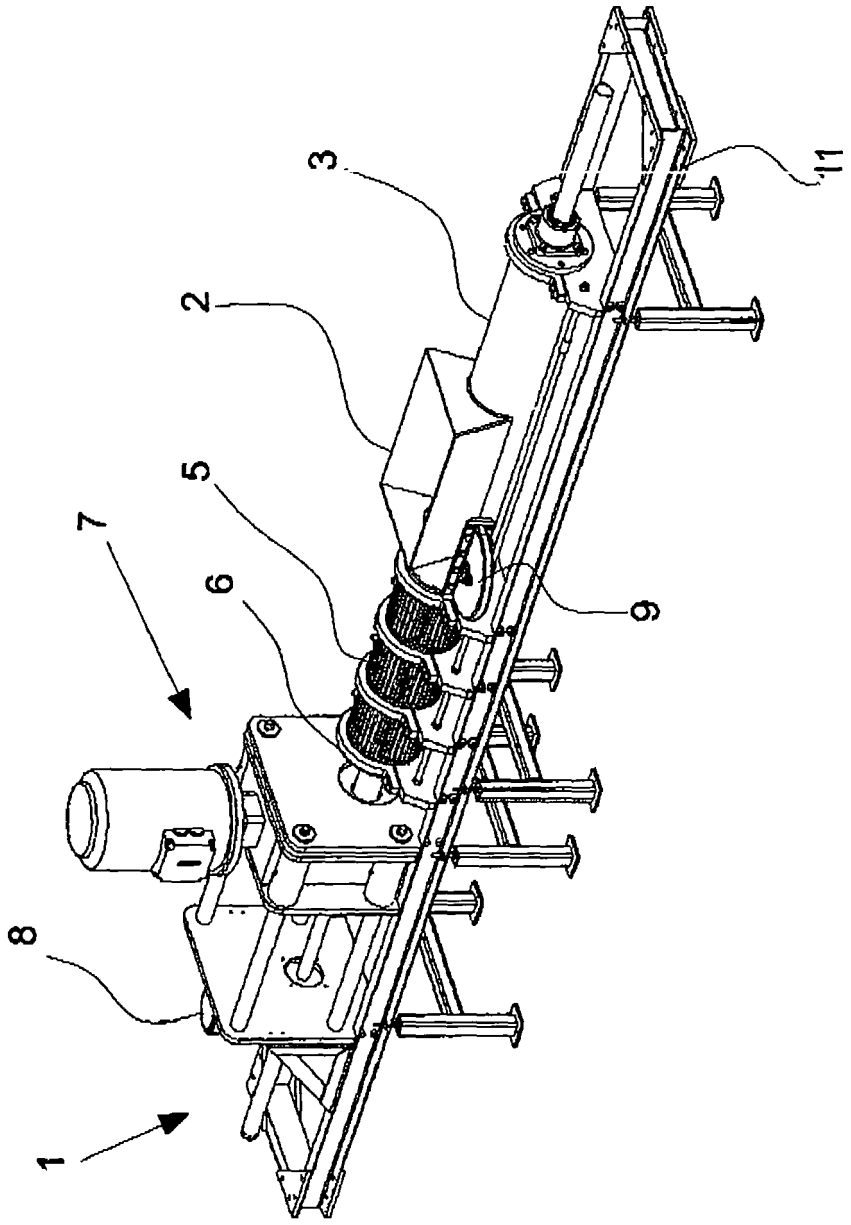

Fig. 1

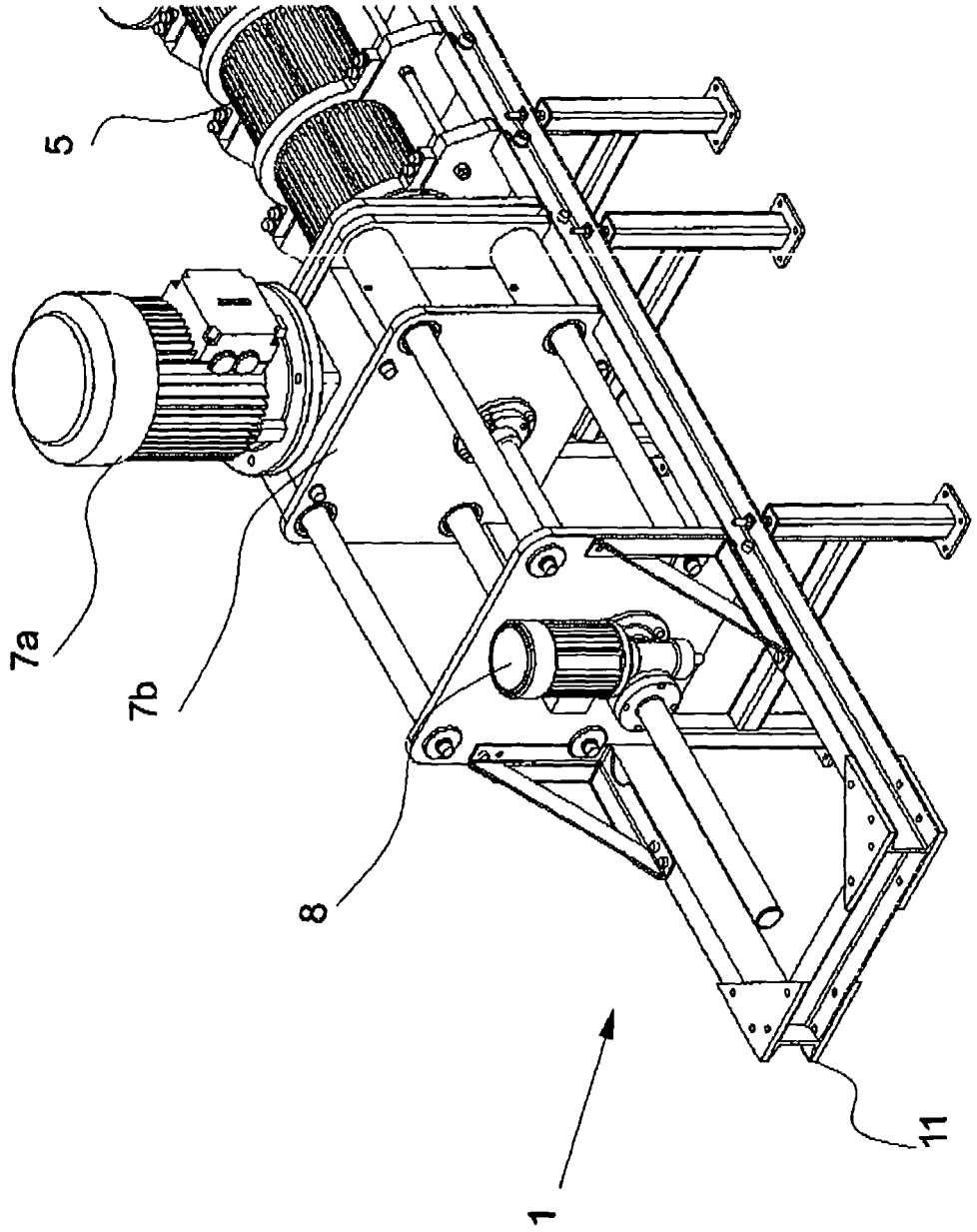

Fig. 2

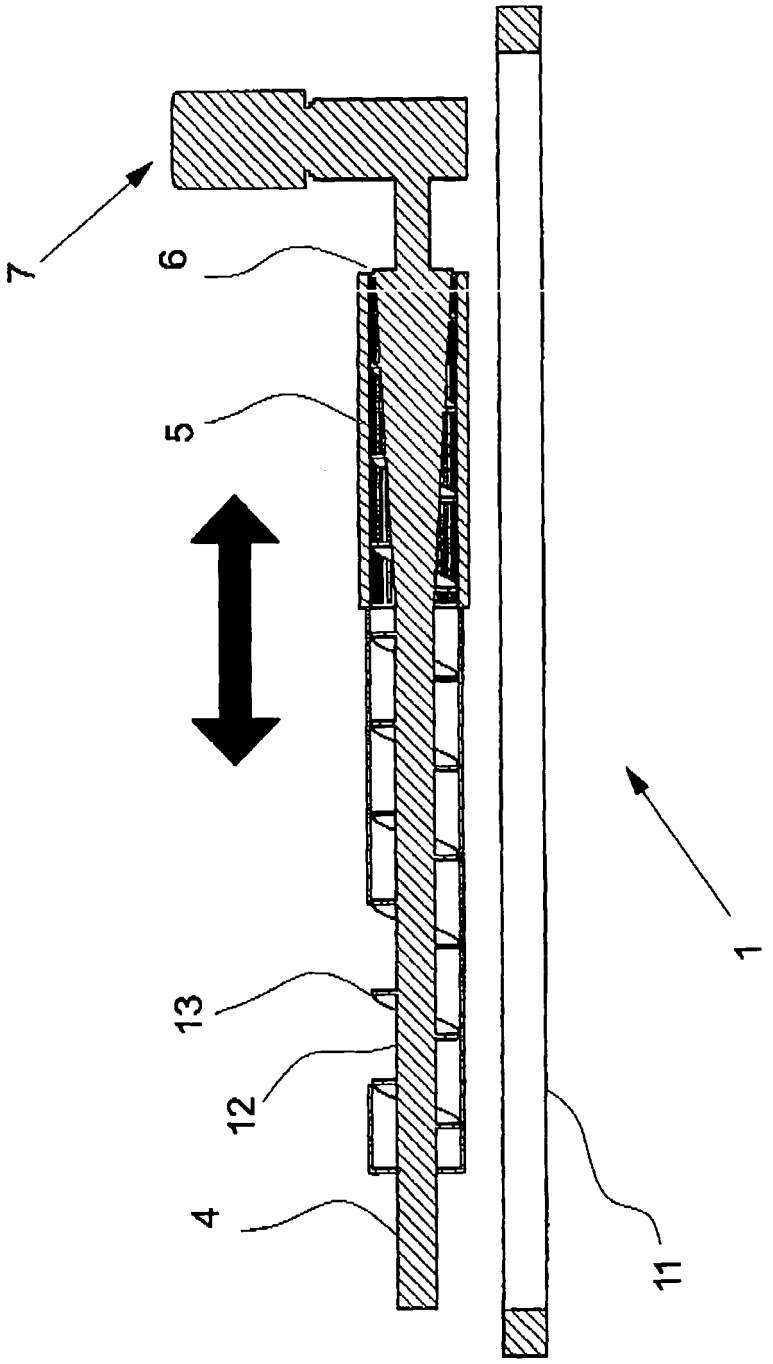

Fig. 3

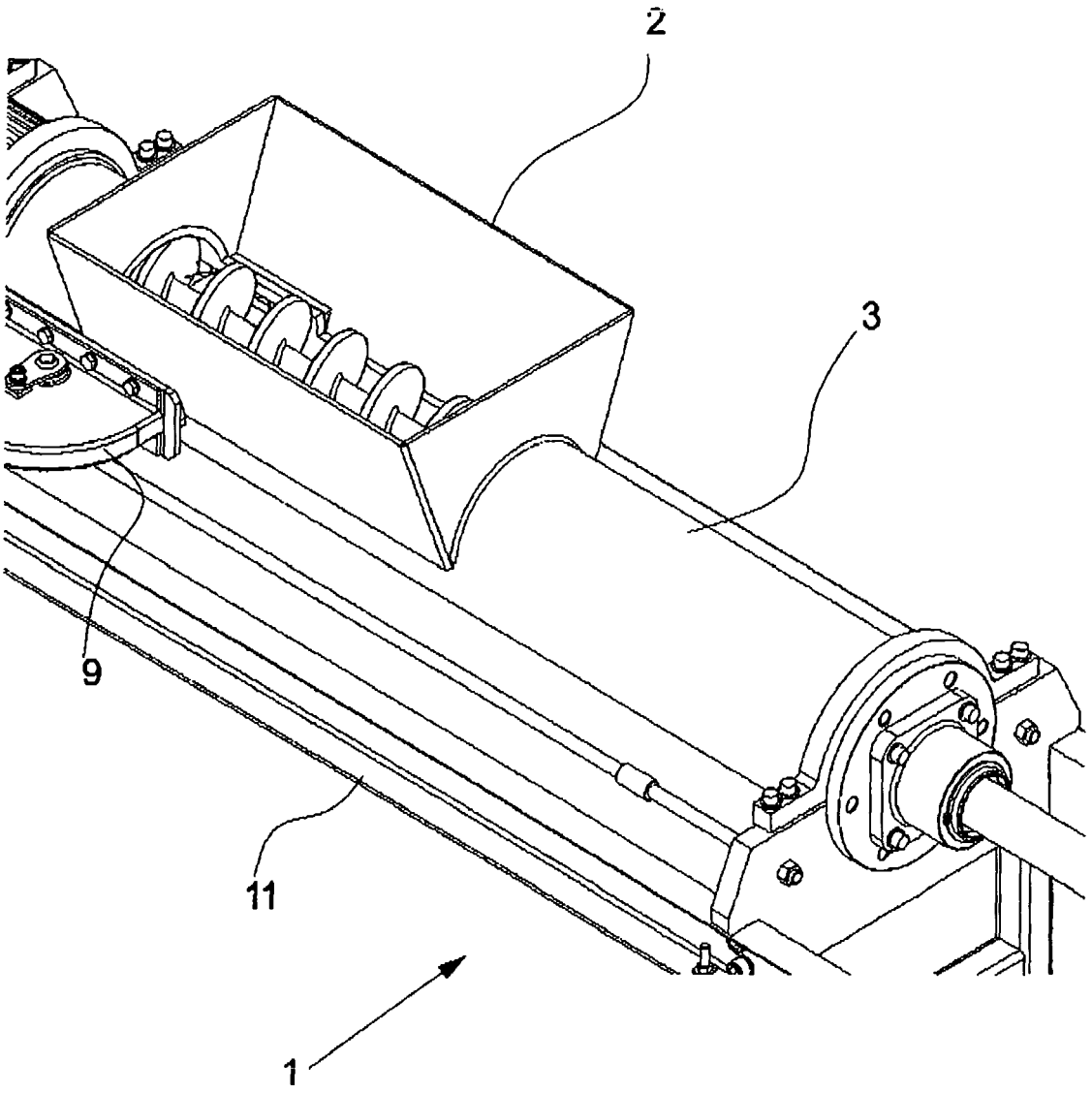

Fig. 4

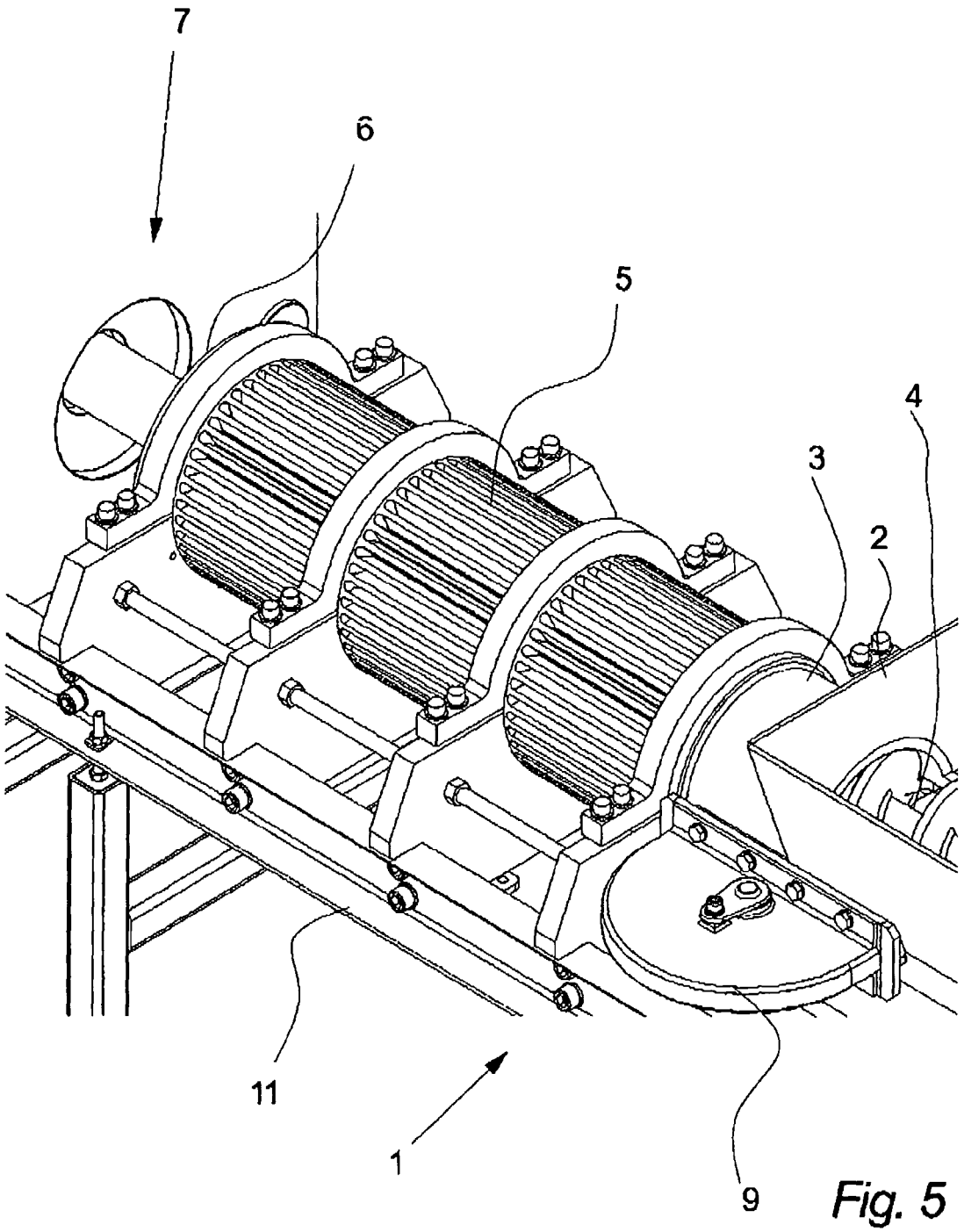

Fig. 5

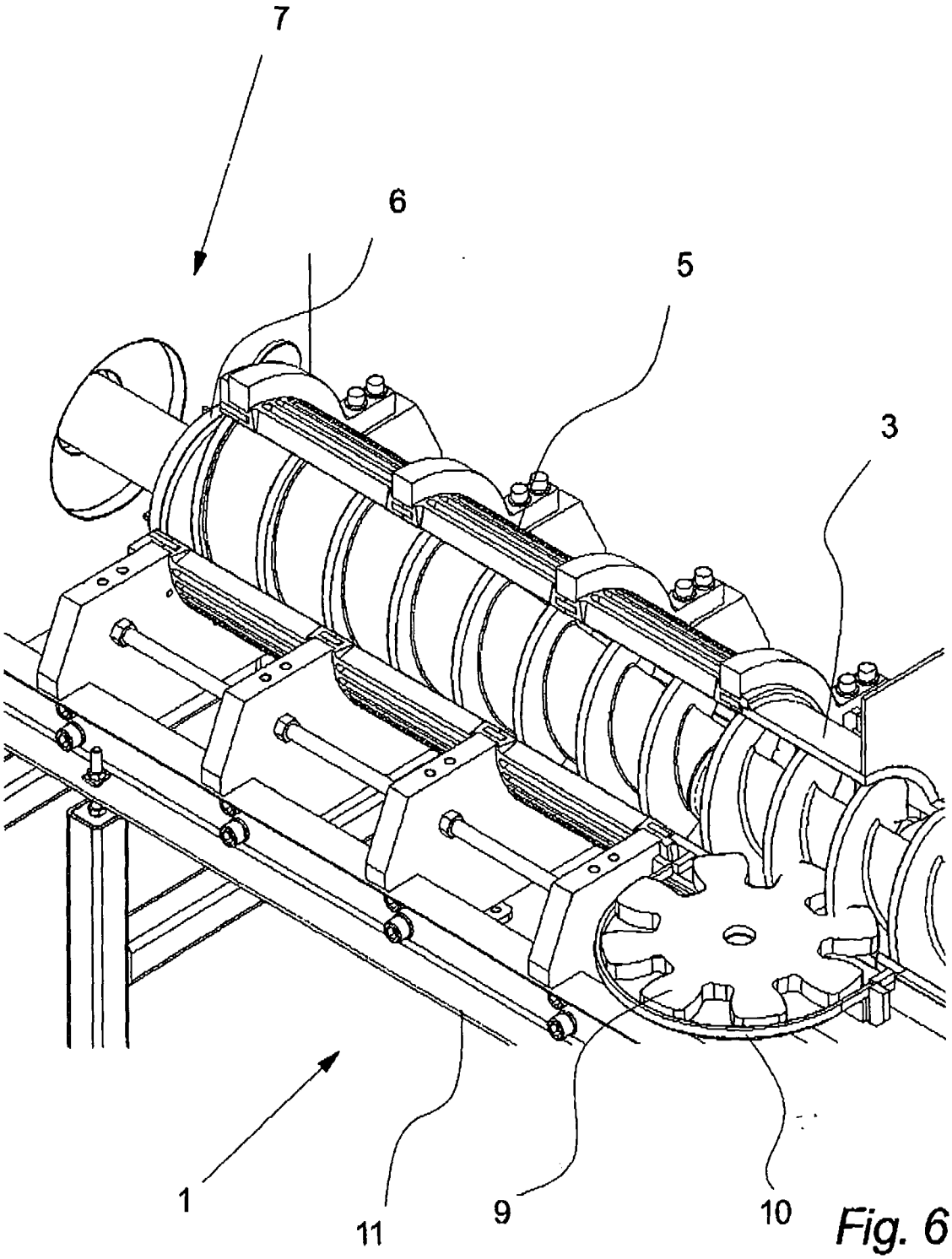

Fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 07 7011

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 1 170 315 A (GEBR. STORK & CO'S APPARATENFABRIEK N.V. BOORSTRAAT 1) 12 November 1969 (1969-11-12)	1,5, 12-15	B30B9/18 B30B9/12
Y	* page 3, line 69 - line 107; figure 2 *	2-4,6-11	
Y	FR 2 324 446 A (PERA DIDIER) 15 April 1977 (1977-04-15) * page 2, line 21 - line 24 * * page 3, line 23 - line 25; figures 1,4 *	2-4	
Y	PATENT ABSTRACTS OF JAPAN vol. 018, no. 229 (M-1598), 26 April 1994 (1994-04-26) & JP 06 023590 A (EBARA INFILCO CO LTD), 1 February 1994 (1994-02-01) * abstract; figures *	6-11	
X	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 03, 31 March 1997 (1997-03-31) & JP 08 309589 A (SEKISUI ENVIRONMENT KK; YANAGAWA GIKEN:KK), 26 November 1996 (1996-11-26) * abstract *	1,12-15	
A	PATENT ABSTRACTS OF JAPAN vol. 016, no. 346 (M-1286), 27 July 1992 (1992-07-27) & JP 04 105795 A (ISHIGAKI MECH IND CO), 7 April 1992 (1992-04-07) * abstract; figure *	1,5-11	
A	US 3 143 956 A (HURTIG ROY E) 11 August 1964 (1964-08-11) * figure *	1,5-11	

-/--

TECHNICAL FIELDS SEARCHED (IPC)

B30B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 February 2006	Belibel, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 07 7011

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 1 376 265 A (KRIMA MASKINFABRIK AB) 4 December 1974 (1974-12-04) * claims 1,2; figure *	1	
A	US 3 126 818 A (KOELSCH) 31 March 1964 (1964-03-31) * figure 1 *	1	
A	WO 01/62482 A (ASSOCIATION GRADIENT; FONDERIES & ATELIERS LUCIEN CHOQUENET; VOROBIEV,) 30 August 2001 (2001-08-30) * page 18, line 26 - line 5; figure 5b *	1	
			TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 February 2006	Belibel, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 07 7011

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-02-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1170315 A	12-11-1969	OA 2739 A	15-12-1970
FR 2324446 A	15-04-1977	DE 2620628 A1	24-03-1977
		ES 450089 A1	01-08-1977
		IT 1058201 B	10-04-1982
		ZA 7603029 A	27-04-1977
JP 06023590 A	01-02-1994	JP 1987319 C	08-11-1995
		JP 7012554 B	15-02-1995
JP 08309589 A	26-11-1996	NONE	
JP 04105795 A	07-04-1992	NONE	
US 3143956 A	11-08-1964	NONE	
GB 1376265 A	04-12-1974	AR 194150 A1	22-06-1973
		SE 358338 B	30-07-1973
US 3126818 A	31-03-1964	NONE	
WO 0162482 A	30-08-2001	AU 3572101 A	03-09-2001
		EP 1257413 A1	20-11-2002
		FR 2805199 A1	24-08-2001

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 9837942 A **[0004]**
- US 6505550 B **[0005]**