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(54) DEVICE FOR SEPARATING MATERIAL SUCH AS MANURE INTO LIQUID FRACTION AND SOLID FRACTION WITH DOUBLE SEPARATING MEANS

(57) The invention relates to a device (1) for separating material into liquid and solid substance. The device comprises a housing (2) which is provided with an inlet (3) for the material, a first outlet (4) for the liquid and a second outlet (5) for the solid substance. Separating means are arranged in the housing for separating the material. The device is provided with a drive (8) for the separating means.

The separating means comprise two conveyor and pressing screws (6A, 6B) running adjacency of each other and substantially parallel to each other. In addition, the housing comprises a sieve cage (12, 13) which at least partially encloses the conveyor and pressing screws.

According to the invention a drainage pipe (14) for liquid is arranged on the sieve cage (12, 13).

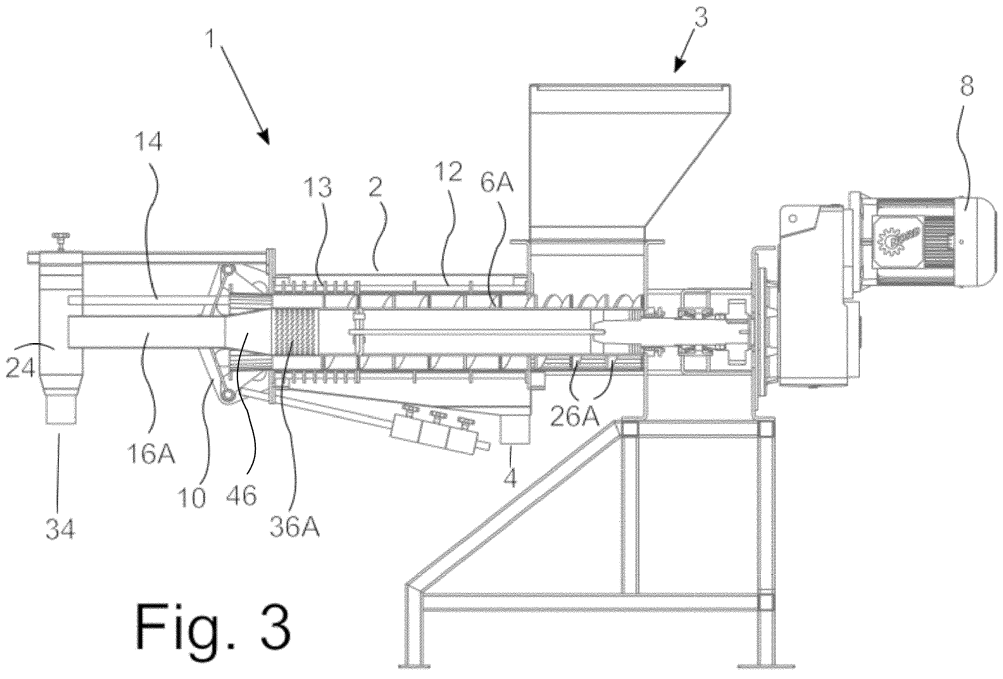

Fig. 3

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Description

[0001] The present invention relates generally to the field of separating material into a liquid fraction and a solid fraction. This separating technique is known within the context of diverse different industrial applications, including arable farming, cattle farming, food industry, water purification and so on.

[0002] The present invention relates particularly to a device for separating material such as manure into liquid and solid substance, the device comprising a housing, which housing is provided with an inlet for the material, a first outlet for the liquid and a second outlet for the solid substance, wherein separating means are arranged in the housing for separating the material, wherein the device is provided with a drive for the separating means.

[0003] Such a device is known from WO 2013/043051 of the same applicant. The known device is able during use to set the outlet opening for the solid substance in accordance with operational parameters of the drive of the separating means. When a solid fraction is too thin, the outlet opening is automatically made smaller and when the solid fraction is too thick the outlet opening is automatically made larger. This means that the known device can be effectively prevented from becoming clogged. The separating process proceeds wholly automatically and the known device functions autonomously. The quality of the solid fraction, and particularly the dry matter content thereof, can moreover be guaranteed. The solid fraction of manure is reused in cattle farming, for instance as cubicle litter. High quality standards are set for this cubicle litter, among other ways in respect of the dry matter content.

[0004] The present invention has for its object to provide an improved device of the type stated in the preamble which can meet the highest quality standards in respect of the end product, i.e. the solid fraction.

[0005] In the device according to the invention the separating means comprise two conveyor and pressing screws running adjacency of each other and substantially parallel to each other, and the housing comprises a sieve cage which at least partially encloses the conveyor and pressing screws.

[0006] The device according to the invention has a larger capacity than the known device and is moreover able to deliver a solid fraction with a higher percentage of dry matter, i.e. 70 to 80%. The sieve cage or sieve drum enclosing the conveyor and pressing screws makes it possible to press out liquid on all sides. While the sieve cage does have to fit closely round the conveyor and pressing screws, it is found in practice that some clearance is allowed. The device according to the invention can separate a heterogeneous material. The device according to the invention can moreover co-act with diverse 'heads' on the outlet for the solid fraction.

[0007] A device according to the preamble of claim 1 is known from the international patent application WO 2004/080704.

[0008] The device according to the invention is distinguished from the known device in that a drainage pipe is arranged on the sieve cage to discharge the liquid leaving the sieve cage on the upper side. The drainage pipe forms a third outlet with which liquid is prevented in effective manner from remaining behind on the sieve cage.

[0009] In a first preferred embodiment the drainage pipe is connected to a collecting container with a (collecting) outlet.

[0010] In a further preferred embodiment the shaft of each conveyor and pressing screw takes an at least partially hollow form and is provided with sieve openings. By means of the sieve openings more liquid can be discharged through the hollow shaft to a further liquid outlet. The percentage of dry matter rises 6% at an equal power. A solid fraction with an even higher content of dry matter can thus be obtained.

[0011] According to a practical preferred embodiment, the hollow shafts likewise debouch into the collecting container so that the liquid discharged through sieve openings likewise flows to the collecting outlet.

[0012] The sieve openings are preferably slots lying at an angle relative to the longitudinal direction of the conveyor and pressing screw. These specific slots do not become clogged, or hardly so. In a practical preferred embodiment the sieve openings are located adjacently of the screw blade. The pressure chamber begins here.

[0013] In another preferred embodiment the shaft of each conveyor and pressing screw takes an at least partially conical form. The shaft constriction is preferably located in the pressure chamber in order to prevent the screw jamming.

[0014] In an elegant preferred embodiment the sieve cage has a generally figure of eight shape. The figure eight is complementary to the two mutually adjacent conveyor and pressing screws and can enclose them with some clearance, whereby the device according to the invention can function optimally.

[0015] According to the further development of this preferred embodiment, the sieve cage comprises a first part with sieve openings of a first type and a second part with sieve openings of a second type, wherein the second type of sieve openings differs from the first type of sieve openings. In advantageous manner at least the part of the sieve cage forms a pressure chamber or pressure sieve.

[0016] In a further preferred embodiment the conveyor and pressing screws are mutually engaging. The conveyor and pressing screws are as a result self-cleaning. Hardly any material is left behind. Substantially all the material is transported in the direction of transport.

[0017] In an optimal preferred embodiment one of the conveyor and pressing screws is left-rotating and one of the conveyor and pressing screws is right-rotating, and the drive is configured to rotate the conveyor and pressing screws in opposing directions toward each other. In the optimal preferred embodiment the material is distributed all around the conveyor and pressing screws. The

material functions here as a bearing for the conveyor and pressing screws. This distribution of material results in a uniform load on the conveyor and pressing screws, whereby they are less susceptible to wear and have a longer lifespan.

[0018] The invention will now be further elucidated with reference to the accompanying figures, in which:

Figure 1 is a schematic view of a device according to the invention;
Figure 2 is a top view of the device according to figure 1;
Figure 3 shows a longitudinal section through the device according to figure 1; and
Figure 4 is an exploded view of the device according to figure 1.

[0019] Figure 1 is a schematic view of a first preferred embodiment of a device 1 according to the invention. In the shown preferred embodiment device 1 is intended for the purpose of separating manure into a liquid fraction and a solid fraction. Device 1 is provided with a housing 2 in which separating means are arranged. Housing 2 is provided with an inlet 3 for the manure, a first outlet 4 for the liquid fraction and a second outlet 5 for the solid fraction. A drive 8 is arranged for driving the separating means. In the shown preferred embodiment drive 8 is an electric motor. Such a device is also known in the field as a screw press/pump.

[0020] Figure 2 is a schematic top view of device 1. Figure 3 shows a longitudinal section through device 1. Figure 4 shows device 1 with exploded parts.

[0021] According to the invention the separating means comprise two screws 6A and 6B running adjacency of each other and substantially parallel to each other for the purpose of transporting the material in transport direction T. Screws 6A and 6B are designated in the context of this invention as conveyor and pressing screws, but can also be referred to as conveyor screws or pressing screws or augers. Each of the conveyor and pressing screws is provided with a respective shaft 16A, 16B. A screw blade 26A, 26B is arranged over at least a part of the respective shaft. In the shown preferred embodiment the conveyor and pressing screws 6A, 6B are mutually engaging.

[0022] Housing 2 further comprises a sieve cage or sieve drum 12, 13 which at least partially encloses conveyor and pressing screws 6A, 6B for the purpose of compressing the material to a solid fraction, wherein a liquid fraction is separated. Outlet 5 for the solid fraction is provided with a head 10 which can at least partially close outlet 5. Diverse suitable heads are known in the relevant field. A suitable head can be operated manually or automatically. A head provided with an opening with adjustable dimensions, as described in the above stated international patent application WO 2013/043051, is likewise suitable.

[0023] Conveyor and pressing screws 6A, 6B, sieve cage 12, 13 and head 10 co-act in order to build up a pressure which increases in transport direction T. The solid fraction is compressed and leaves outlet 5 slowly, while the liquid which has been pressed out is discharged via outlet 4.

[0024] The screw blades of the conveyor and pressing screws have a mirrored orientation. In the shown preferred embodiment conveyor and pressing screw 6A is left-rotating and conveyor and pressing screw 6B is right-rotating. Conveyor and pressing screw 6A is driven to the right (clockwise) while conveyor and pressing screw 6B is driven to the left (counter-clockwise). A suitable material for the conveyor and pressing screws according to the invention is steel, preferably stainless steel. The steel is optionally covered with plastic material.

[0025] Shaft 16A, 16B takes an at least partially hollow form and is provided with sieve openings 36A, 36B. In the shown preferred embodiment sieve openings 36A, 36B are generally slot-like. The slot-like sieve openings 36A, 36B preferably lie at an angle differing from zero relative to the longitudinal direction of the conveyor and pressing screw. In the shown preferred embodiment sieve openings 36A, 36B are located adjacently of screw blades 26A, 26B respectively.

[0026] Shaft 16A, 16B has a diameter decreasing in transport direction T. In order to achieve this, shaft 16A, 16B takes a partially conical form. The shaft constriction 46 is located adjacently of sieve openings 36A.

[0027] Sieve cage 12, 13 is arranged with some clearance round conveyor and pressing screws 6A, 6B. In the shown preferred embodiment the sieve cage has the general shape of a figure of eight. Sieve cage 12, 13 is preferably located centrally round the conveyor and pressing screws, i.e. the conveyor and pressing screws protrude on both sides of the sieve cage. Sieve openings 36 are preferably located at the beginning of pressure chamber 13 and shaft constriction 46 is preferably located at the end of pressure chamber 13. Head 10 is provided with openings for shafts 16A, 16B.

[0028] In the shown preferred embodiment the sieve cage comprises a first part 12 with sieve openings of a first type and a second part 13 with sieve openings of a second type. The second type and the first type of sieve openings are different. The sieve openings in part 12 are preferably substantially round perforations, while the sieve openings in part 13 are preferably generally slot-like.

[0029] Arranged on sieve cage 12, 13 is a pipe 14 for discharging the liquid leaving the sieve cage on the upper side. Pipe 14 is connected to a collecting container 24 with an outlet 34.

[0030] Hollow shafts 16A and 16B likewise debouch into this collecting container 24 so that the liquid discharged through sieve openings 36A and 36B likewise flows to outlet 34. Outlet 34 forms a collecting outlet and a further outlet for the liquid.

[0031] Although the present invention has been elucidated on the basis of a preferred embodiment for sepa-

rating manure, the invention is not limited to this application. The invention provides a separator for separating diverse types of material into a solid fraction and a liquid fraction, for instance in the context of recycling. By applying the co-acting screws enclosed by a sieve cage the separator according to the invention is suitable for a wide variety of input materials. The input materials can for instance be biological, wherein tomato stems or hemp leaves can also be compressed in addition to manure. The separator is able to deliver a very dry solid fraction and to remove the maximum amount of liquid from the input material. In the case of hemp leaves the liquid is the end product which can be sold as medicinal beverage. In the case of manure the solid substance is the end product intended as cubicle litter, for instance in the context of bio-bedding. In the case of tomato stems the solid substance is also the end product and intended for cardboard production. Other input materials which have not been mentioned can also be processed by the separator according to the invention. These input materials can vary from highly liquid to very solid.

[0032] The invention therefore extends to any embodiment falling within the scope of protection as defined in the claims and as seen in the light of the foregoing description and accompanying drawings.

Claims

1. Device (1) for separating material such as manure into liquid and solid substance, the device comprising a housing (2), which housing is provided with an inlet (3) for the material, a first outlet (4) for the liquid and a second outlet (5) for the solid substance, wherein separating means are arranged in the housing for separating the material, wherein the device is provided with a drive (8) for the separating means, wherein the separating means comprise two conveyor and pressing screws (6A, 6B) running adjacency of each other and substantially parallel to each other, and wherein the housing comprises a sieve cage (12, 13) which at least partially encloses the conveyor and pressing screws, **characterized in that** a drainage pipe (14) for liquid is arranged on the sieve cage (12, 13).

2. Device as claimed in claim 1, wherein the drainage pipe (14) is connected to a collecting container (24) with an outlet (34).

3. Device as claimed in claim 1 or 2, wherein the shaft (16A, 16B) of each conveyor and pressing screw (6A, 6B) takes an at least partially hollow form and is provided with sieve openings (36A, 36B).

4. Device as claimed in claims 2 and 3, wherein the shafts (16A, 16B) debouch into the collecting container (24).

5. Device as claimed in claim 3 or 4, wherein the sieve openings are slots (36A, 36B) lying at an angle relative to the longitudinal direction of the conveyor and pressing screw (6A, 6B).

6. Device as claimed in claim 3, 4 or 5, wherein the sieve openings (36A, 36B) are located adjacently of the screw blade (26A, 26B).

7. Device as claimed in one or more of the foregoing claims, wherein the shaft (16A, 16B) of each conveyor and pressing screw (6A, 6B) takes an at least partially conical form.

8. Device as claimed in one or more of the foregoing claims, wherein the sieve cage (12, 13) has a generally figure of eight shape.

9. Device as claimed in one or more of the foregoing claims, wherein the sieve cage comprises a first part (12) with sieve openings of a first type and a second part (13) with sieve openings of a second type, wherein the second type of sieve openings differs from the first type of sieve openings.

10. Device as claimed in one or more of the foregoing claims, wherein the conveyor and pressing screws (6A, 6B) are mutually engaging.

11. Device as claimed in one or more of the foregoing claims, wherein one of the conveyor and pressing screws (6A) is left-rotating and wherein one of the conveyor and pressing screws (6B) is right-rotating, and wherein the drive (8) is configured to rotate the conveyor and pressing screws in opposing directions toward each other.

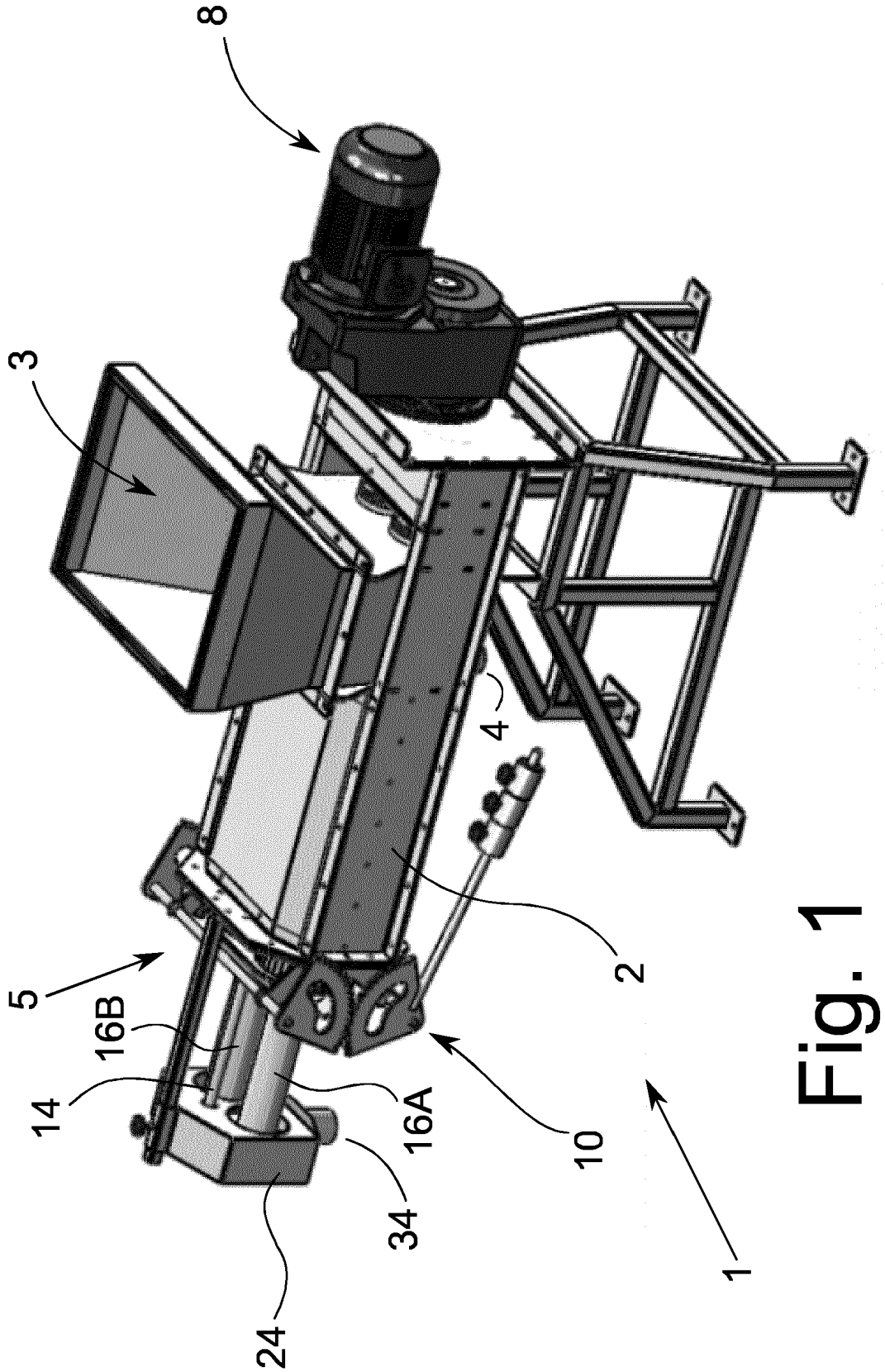

Fig. 1

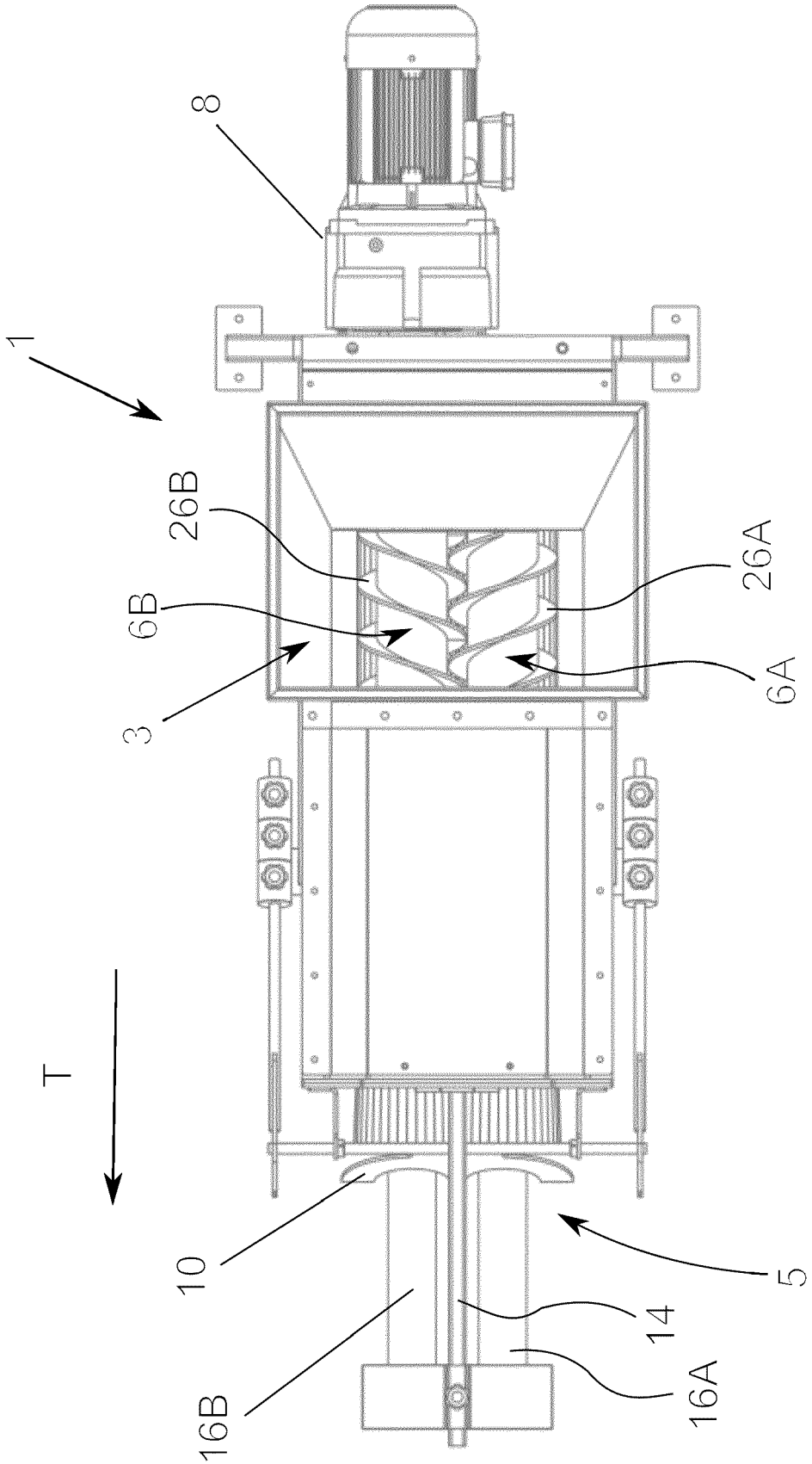

Fig. 2

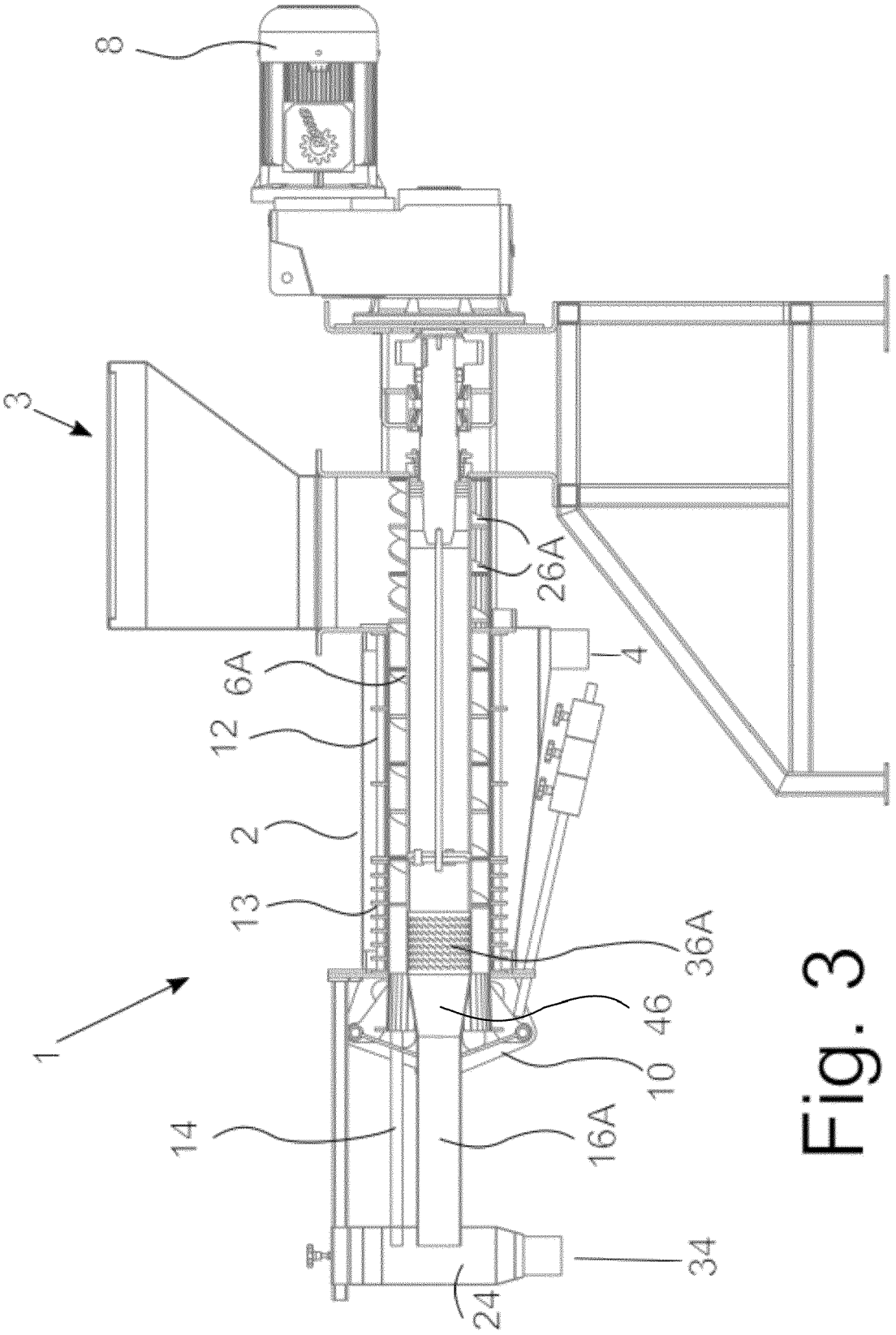

Fig. 3

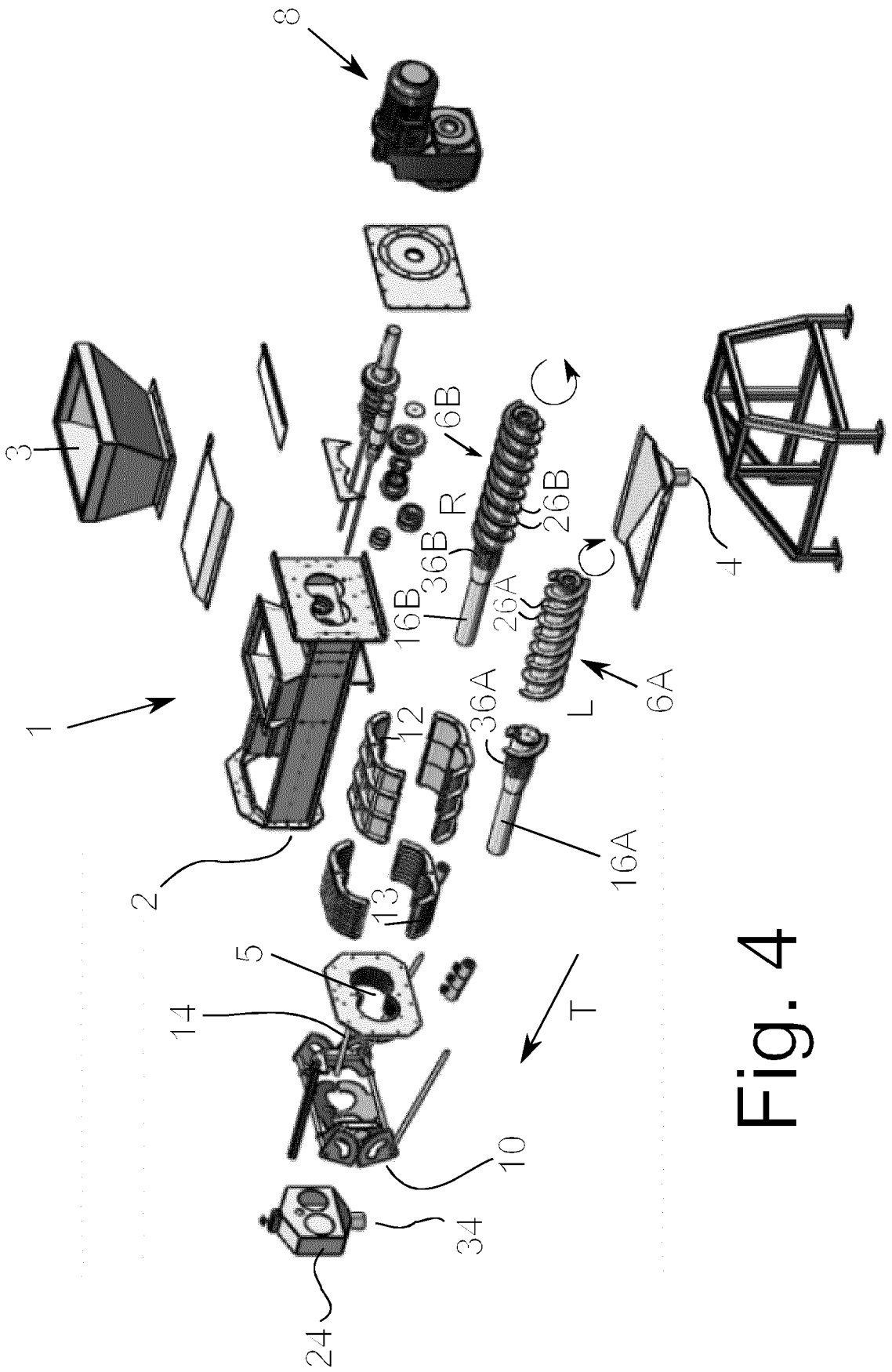

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 16 16 2262

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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	29 September 2016	Labre, Arnaud

CATEGORY OF CITED DOCUMENTS

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

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