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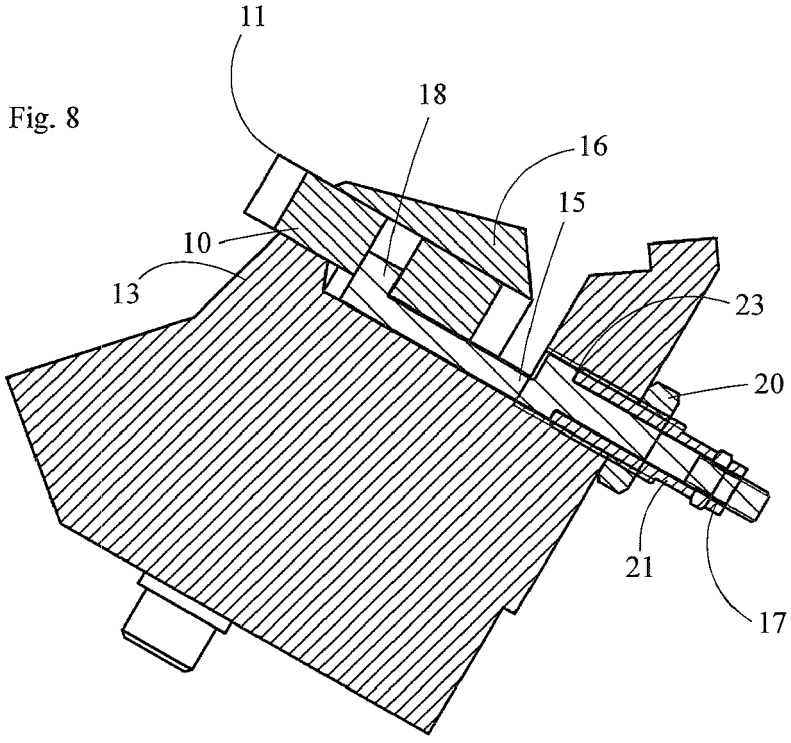
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(54) FIXED KNIFE ASSEMBLY

(57) A knife assembly for a size reduction machine, such as a shredder or a granulator (1) includes a rotor (4), wherein a knife (10) is fixed on a seat (13) and arranged for cooperation with a number of knives (9) on the rotor (4). The fixed knife (10) is planar with a general plane of extension. The fixed knife (10) is held by at least two knife holders (15), which are arranged to displace the knife (10) in a direction which is approximately parallel with its plane of extension.

Fig. 8



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Description

TECHNICAL FIELD

[0001] The present invention concerns a knife assembly for a size reduction machine, such as a shredder or a granulator, which includes a rotor, wherein a knife is fixed on a seat and arranged for cooperation with a number of knives on the rotor, and the knife is planar with a general plane of extension.

[0002] The invention also concerns a size reduction machine, such as a shredder or a granulator.

BACKGROUND ART

[0003] Size reduction machines, such as shredders or granulators, are used in many fields for size reduction of different materials, for example mixed garbage or waste from building sites. They are also used for size reduction of selected, more uniform materials, such as wood or plastics, either to make the material less bulky or to prepare it for further processing.

[0004] Shredders for plastics are often used for preparing large and/or heavy plastic parts for the production of plastic granules in a granulator mill, which requires smaller and more homogeneous parts in order to work as efficiently as possible and with as little down-time as possible. The resulting granules are often recycled in the production of new objects. Shredders work with a slower rotor speed than regular mills, and are more robust, in order to handle large or heavy pieces.

[0005] In general, a shredder is provided with a hopper, for receiving the parts which are to be cut into smaller pieces. A pusher is provided for pushing the parts towards the rotor, which may be provided with knives at one or two levels thereon. The knives on the rotor cooperate with fixed knives, and cut the plastics material between them. If the knives on the rotor are arranged at two different levels, the fixed knives are also arranged to cut the material at two different distances from the center of the rotor, which results in the fixed knives having sharp edges with a jagged appearance. The edge is alternatingly extending to be able to cooperate with the knives in the valleys of the rotor, and alternatingly recessed to be able to cooperate with the knives on the ridges of the rotor.

[0006] In order to work properly, the fixed knives must be at a proper distance from the center of the rotor, so that the rotor may rotate freely, but at the same time its rotating knives should be close enough to the fixed knives to able to cut the material in the shredder.

[0007] As the fixed knives are worn with use and time, they will need to be replaced or removed for maintenance or cleaning. Often this is a complex operation, which calls for demounting of several parts of the shredder, which in turn results in long periods of down-time.

PROBLEM STRUCTURE

[0008] There is thus a need for a fixed knife which is easy to mount and demount, and which may be reliably adjusted into its working position.

SOLUTION

[0009] The objects forming the basis for the present invention are attained if the knife assembly mentioned in the introduction is characterized in that the knife is held by at least two knife holders, which are arranged to displace the knife in a direction which is approximately parallel with its plane of extension.

[0010] The size reduction machine, such as a shredder or a granulator, according to the invention includes the abovementioned knife assembly.

[0011] Further advantages will be attained if the present invention is given one or more features from the subclaims.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0012] The present invention will now be described in greater detail hereinbelow, with reference to the accompanying drawings. In the accompanying drawings:

- Fig. 1 shows a perspective view of a shredder according to the invention;
- Fig. 2 is a section through the shredder according to Fig. 1;
- Fig. 3 shows a perspective view of a rotor included in the shredder according to the invention;
- Fig. 4 is a plan view of the rotor according to Fig. 3;
- Fig. 5 is a section through the rotor and fixed knives in the shredder;
- Fig. 6 shows a perspective view of the fixed knives and a seat therefor;
- Fig. 7 is a perspective view of a fixed knife and two knife holders;
- Fig. 8 is a section through the knife and one of the knife holders;
- Fig. 9 shows one of the knife holders in a perspective view; and
- Fig. 10 is an exploded view of the knife holder.

DESCRIPTION OF PREFERRED EMBODIMENT

[0013] Fig. 1 shows a shredder 1 according to the invention. As with most shredders according to the prior art, the shredder 1 has a hopper 2 into which the plastic material, which is to be comminuted, is to be received. The shredder is also provided with a pusher 3, which pushes the material towards a rotor 4, which cuts the material into smaller pieces with the aid of knives on the rotor 4 and at least one stationary knife. Typically, large lumps of plastics may be cut into uniformly sized chips.

[0014] There is also an outlet 5, for evacuation of the uniformly sized chips of plastic material resulting from the cutting by the rotor 4. The outlet 5 may be connected to a conveyor, for transporting the plastic chips to a granulating mill and from there into the production of goods.

[0015] Fig. 2 shows a section of the shredder according to Fig. 1. From the section it is clear how the hopper 2 funnels down into a narrower, lower part 2a, wherein the pusher 3 operates in order to make sure that all the material reaches the rotor 4, and is eventually cut into smaller pieces. These smaller pieces are fed into the outlet 5, which is next to the rotor 4, as can be seen in Fig. 2.

[0016] Fig. 3 is a perspective view of the rotor 4. The rotor is provided with a screen 6, which is perforated. The screen is arranged on that side of the rotor 4 which faces away from the lower part 2a of the hopper 2. When the plastic chips, resulting from the cutting operation, are small enough to pass through the holes in the screen 6, they will proceed to the outlet 5, as described above.

[0017] The uncovered side of the rotor 4 may be discerned in Fig. 3. The rotor 4 is provided with annular ridges 7 and valleys 8. A number of knives 9 are arranged on the ridges 7 as well as in the valleys 8, which will be clearer in Fig. 4, which is a plan view of the rotor 4.

[0018] The arrangement of the knives 9 is known as such in the prior art, and serves to distribute the reaction forces from the cutting, so that the operation of the shredder 1 will run as smoothly and efficiently as possible. Also, the distribution allows the material, which is to be cut, to advance in small steps towards the rotor 4, each time the rotor 4 has rotated half a turn, as the knives 9 are alternatingly arranged at an outer level of the rotor 4, on the ridges 7, on the first half and at an inner level, in the valleys 8, on the second half.

[0019] The knives 9 that are mounted in the valleys 8 are arranged at an inner level, i. e. at a level closer to the center, of the rotor 4, while the knives 9 at the ridges 7 are arranged at an outer level. The two levels of knives 9 will enable the pusher 3 to push the plastic material to be shredded forward towards the rotor 4 in small steps, where it will alternatingly be cut by the knives 9 at the outer level and the inner level, respectively.

[0020] Next to the rotor 4, a number of fixed knives 10 are arranged, in order to cooperate with the knives 9 on the rotor 4, for cutting the material in the shredder 1. The sharp edges 11 of the fixed knives 10 have a shape which is complementary to the profile of the rotor 4 with its ridges 7 and valleys 8. The knives 10 are also provided with a number of bores 12 for fastening the knives 10 on a seat close to the rotor 4.

[0021] In Fig. 5 the rotor 4, the seat 13 and the fixed knife 10 are visible in a sectional view. A bolt 14 extends transversally to the plane of extension of the fixed knife 10, through the seat 13 and into a threaded bore 12 in the knife 10, thereby fixing the knife 10 on the seat, both in the plane of extension of the knife 10 and in the direction of the bolt 14. In a preferred embodiment, each fixed knife 10 is fixed to the seat 13 by at least two bolts 14.

[0022] In order to adjust and position the knife 10 in its plane of extension, knife holders 15 are arranged to extend directly below the knife 10, however slightly offset from the bolt 14.

[0023] Fig. 6 shows the knives 10 mounted on the seat 13 from a different angle. The outer ends of the knife holders 15 are visible, as well as their respective means for adjustment, i. a. back lock nuts 17 in the preferred embodiment. The means for adjustment will be described in greater detail in connection with Figs 7-10 below. As the means for adjustment are tightened or loosened, the positions of the knife holders 15, and of the knives 10, are adjusted. On top of the fixed knives 10 is a ruler 16, which keeps debris and partly shredded material from accumulating in the bores 12 or at the back edges of the knives 10. The forward sharp edges 11 are free to cooperate with the knives 9 on the rotor 4.

[0024] The knife holders 15 are manufactured separate from the seat, and they may be easily removed or exchanged during cleaning or maintenance of the shredder 1. The adjustment means include several nuts 17, 20 in order to fix the knife holder 15 in the seat 13, and keep it from longitudinal movements in both directions.

[0025] One of the knives 10 is shown in Fig. 7. The knife holders 15 are arranged below the knife 10, and engage with the oval bores 12a. The back lock nuts 17 are screwed onto the outer ends of the knife holders 15, and locked in their respective positions, in order to serve as a back limit for an adjustment sleeve 21 on each knife holder 15. The forward lock nuts 20 are in threaded engagement with the outside of the sleeves 21.

[0026] As the adjustment sleeves 21 are tensioned, i. e. rotated clockwise, the inner end of each sleeve will push against a transversal surface 23 on the knife holder 15, thereby pushing the knife holder 15 and the knife 10 forward, i. e. towards the rotor 4, due to the engagement of the studs 18 (see fig 8) with the oval bores 12a.

[0027] If the adjustment sleeves 21 are loosened, i. e. rotated counterclockwise, the back end surface of the sleeve 21 will press against the back lock nuts 17, which are fixed on the outer ends of the knife holders 15. The knife holder 15 will be gradually pulled out and the knife will be pulled away from the rotor 4. The forward lock nuts 20 will be tensioned for fixing the knife holders 15 in position relative to the seat 13.

[0028] The thickness of the knife 10 is sufficient for providing it with upper and lower sharp edges 11 at both its forward edge and its back edge. Hence there are four sharp edges on the knife 10. The shapes and positions of the bores 12, 12a are symmetrical, thus making the knife fully turnable, so that any one of the four sharp edges may be facing forward and upwards, thus cooperating with the knives 9 on the rotor 4.

[0029] The sectional view shown in Fig. 8 is a section at the position of one of the knife holders 15. The knife holder 15 extends along the lower surface of the knife 10. At one end there is a transversal stud 18, which extends into the oval bore 12a in the knife 10, keeping it in

a position which is determined by the length of the knife holder 15 and the adjustment of the knife holder 15 in relation to the seat 13. The adjustment is determined, in its turn, by the position of the adjustment sleeve 21 at the outer end of the knife holder 15.

[0030] Fig. 9 shows the knife holder 15 on its own. In this view, the transversal stud 18 is shown more clearly, as well as a flat portion 19, which is arranged to extend below the upper surface of the seat 13, with a clearance to the lower side of the knife 10.

[0031] Fig. 10 is an exploded view of the knife holder 15, with all its parts clearly visible. The stud 18, for contact with the knife 10, is seen at the left in fig. 10. The knife holder 15 also has its flat portion 19, as described above and an outer, partly threaded portion 22. The sleeve 21 is rotatably mounted onto the outer portion 22 of the knife holder 15, but it is not in a threaded engagement therewith, as only the outer end of the outer portion 22 is threaded. The sleeve 21 has a portion 21a with an outer thread and a hexagonal part 21b. The hexagonal part 21b is suitable for manipulation with a wrench or the like.

[0032] The lock nut 20 fits on the sleeve portion 21a with the outer thread, and it will fix the position of the knife holder 15 in relation to the seat 13, once the sleeve 21 has attained its desired position on the outer part 22 of the knife holder 15.

[0033] The back lock nuts 17 fit on the outer, threaded end of the outer part 22 of the knife holder 15. When they are locked in their position, e. g. by the use of a locking fluid, they serve as a limit of how far back the sleeve 21 may move on the outer part 22 of the knife holder 15..

ALTERNATIVE EMBODIMENTS

[0034] The invention has been described in relation to a shredder 1 with knives 9 arranged at two different levels, with fixed knives 10, which have contours that are complimentary to the arrangement of the knives 9 on the rotor 4. With a different rotor, whereon the knives are arranged in a different manner, the outer contours of the fixed knives 10 may be entirely different. However, the arrangement of the knife holders 15 and the positioning of the fixed knives 10 would be the same as described above, regardless of the outer contours of the knives 10. Also, there would still be several sharp edges 11 on the knives 10, to be used by turning the knives 10 in different directions.

[0035] The invention may be further modified within the scope of the claims.

Claims

1. Knife assembly for a size reduction machine, such as a shredder or a granulator (1), which includes a rotor (4), wherein a knife (10) is fixed on a seat (13) and arranged for cooperation with a number of knives (9) on the rotor (4), and the fixed knife (10) is planar with a general plane of extension, **characterized in that** the fixed knife (10) is held by at least two knife holders (15), which are arranged to displace the knife (10) in a direction which is approximately parallel with its plane of extension.

2. Knife assembly according to claim 1, **characterized in that** the knife (10) is secured from movements in a direction transversal to its plane of extension by at least two bolts (14) extending through the seat (13) and cooperating with respective bores (12) in the knife (10).

3. Knife assembly according to claim 1 or claim 2, **characterized in that** the knife (10) has at least one symmetry plane, making the knife (10) reversible.

4. Knife assembly according to claim 1, **characterized in that** each knife holder (15) is arranged to extend below the knife (10) on the seat (13)and through a back wall, with a transversal stud (18) arranged to extend into a bore (12a) in the knife (10).

5. Size reduction machine, such as a shredder or a granulator (1) including the knife assembly according to any of claims 1 to 4.

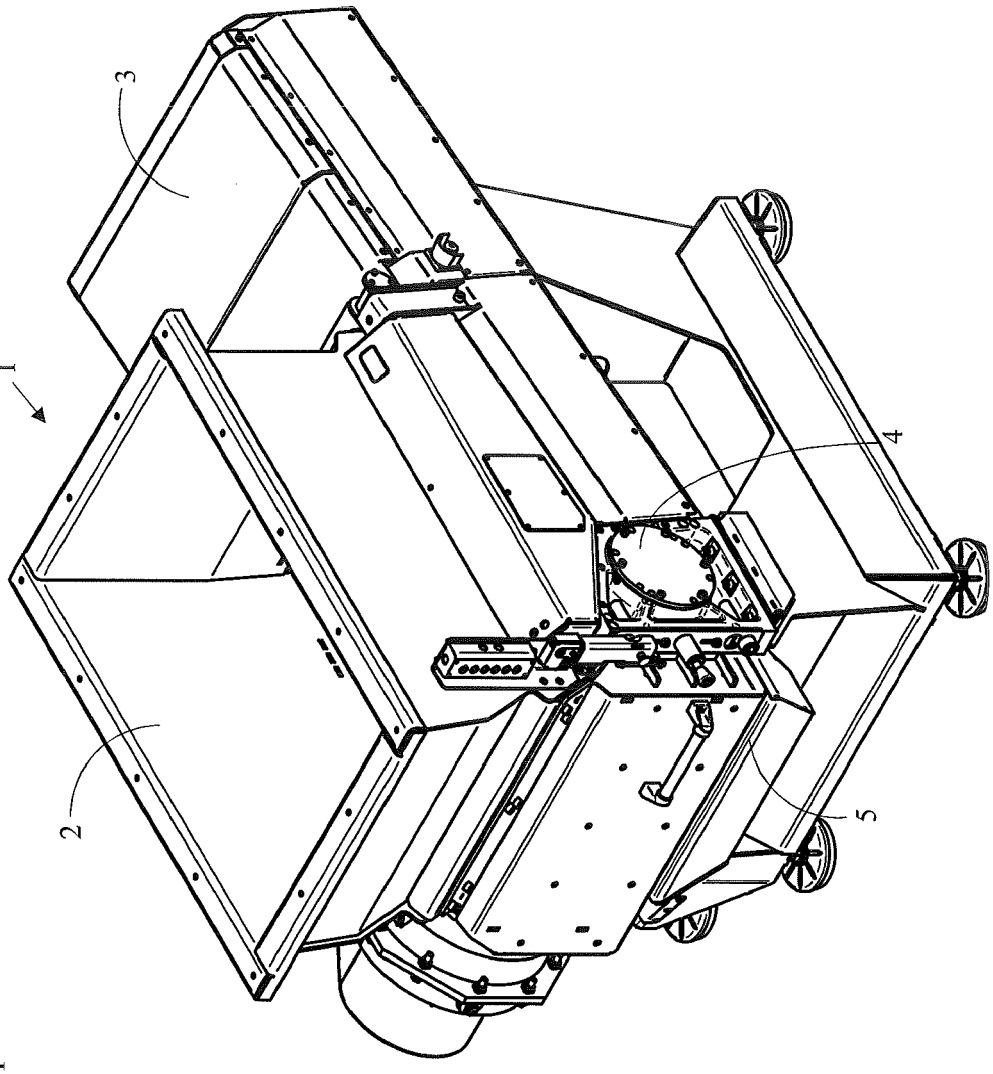


Fig. 1

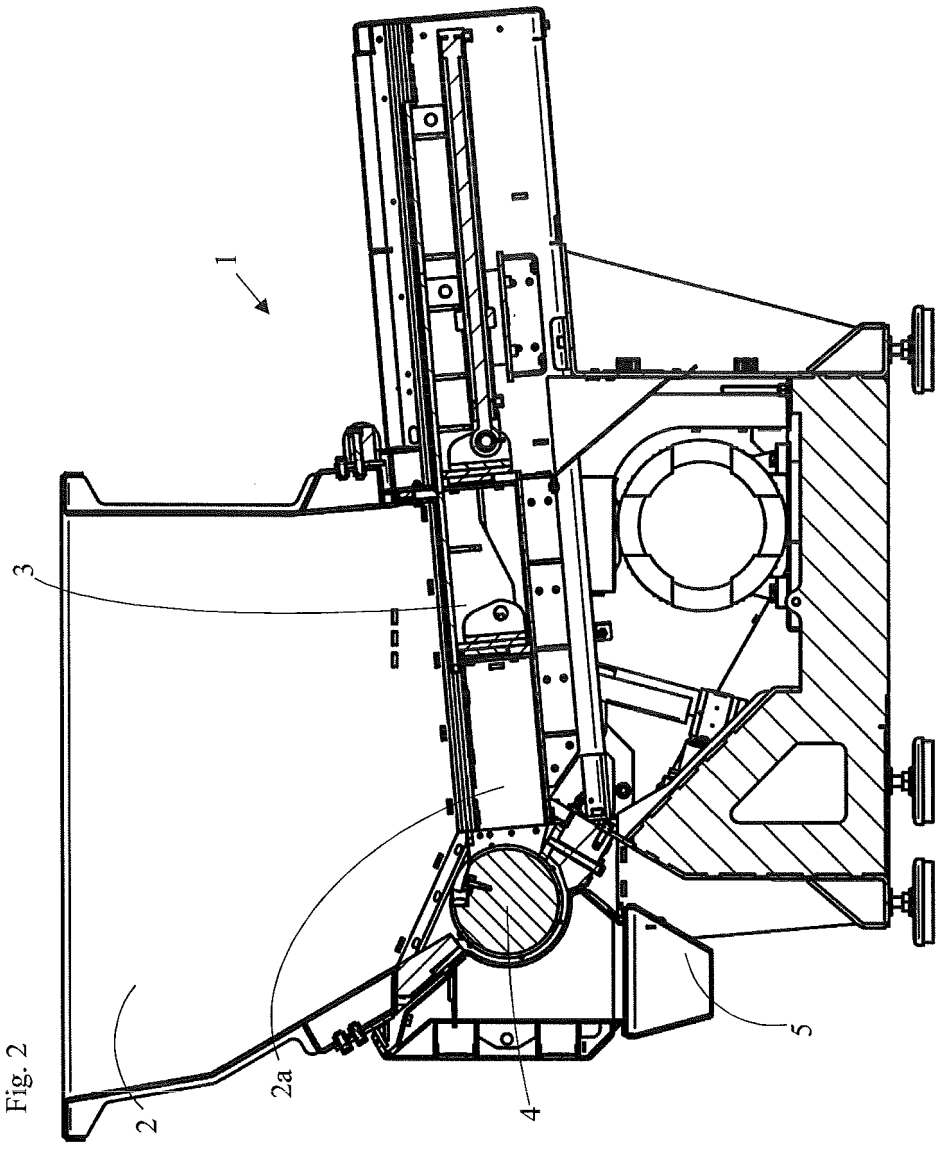


Fig. 2

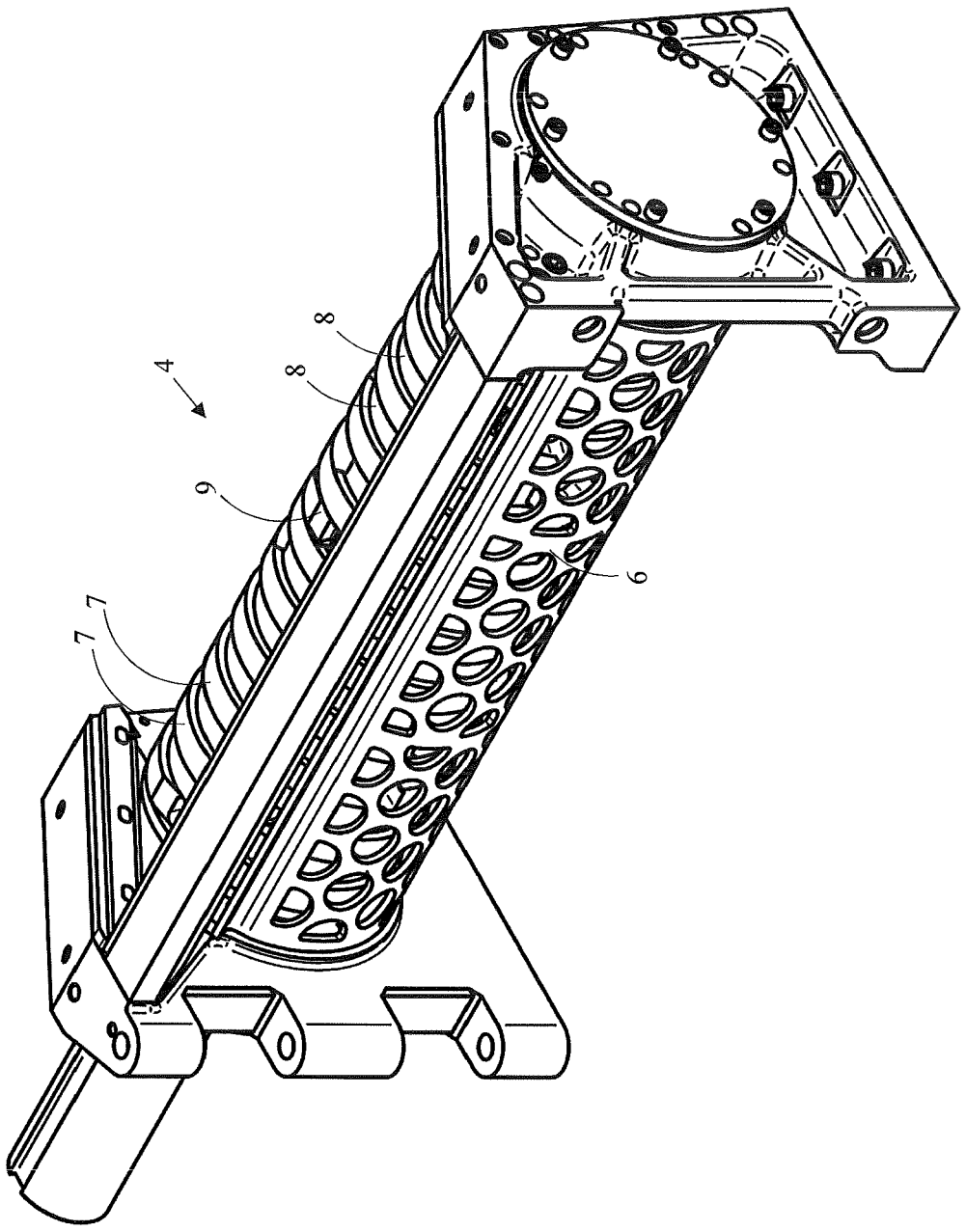


Fig. 3

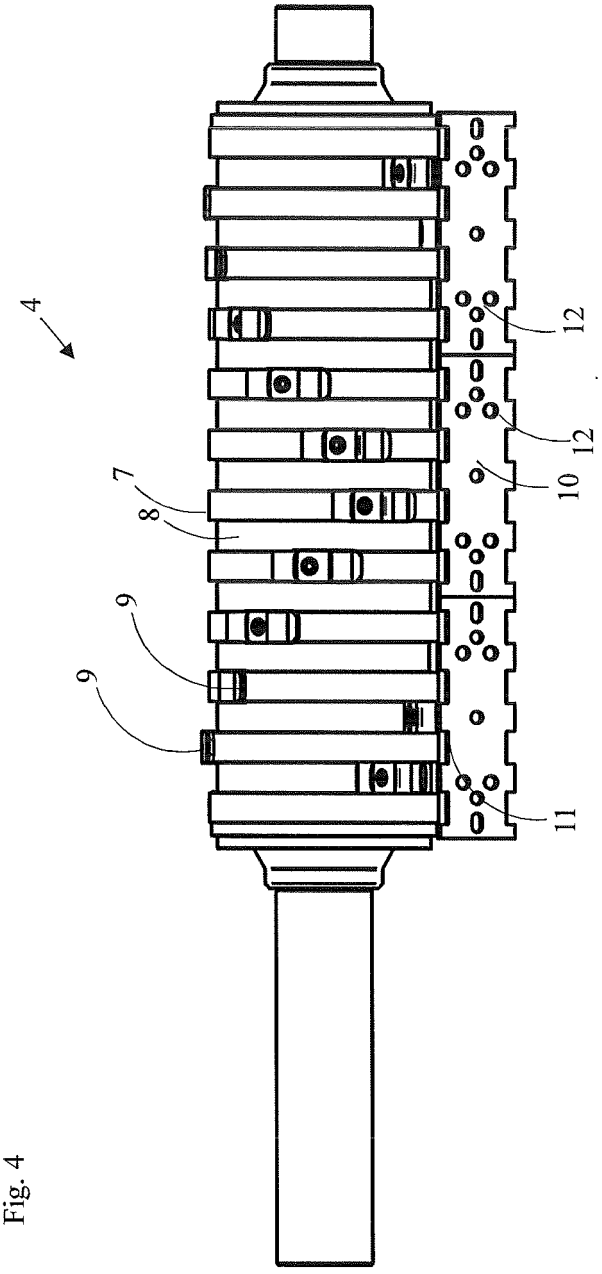


Fig. 4

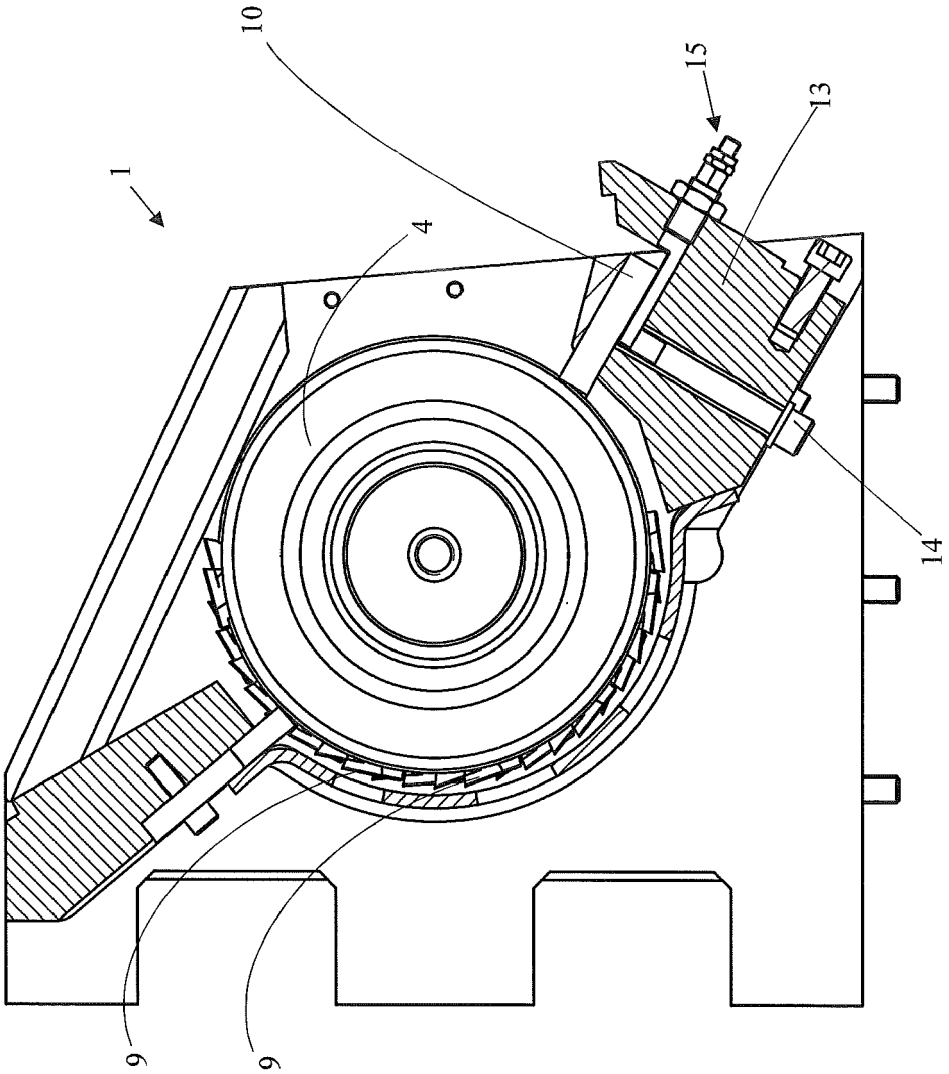


Fig. 5

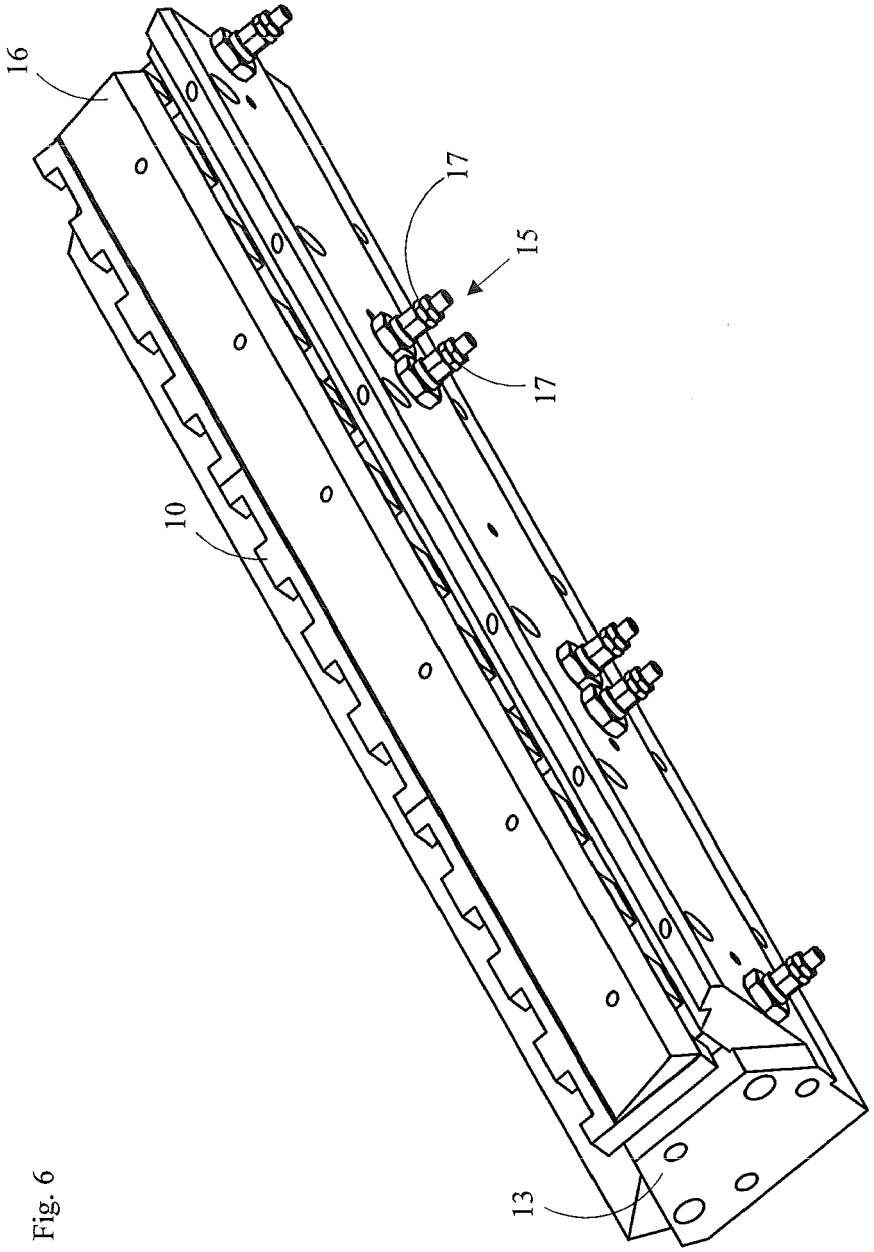


Fig. 6

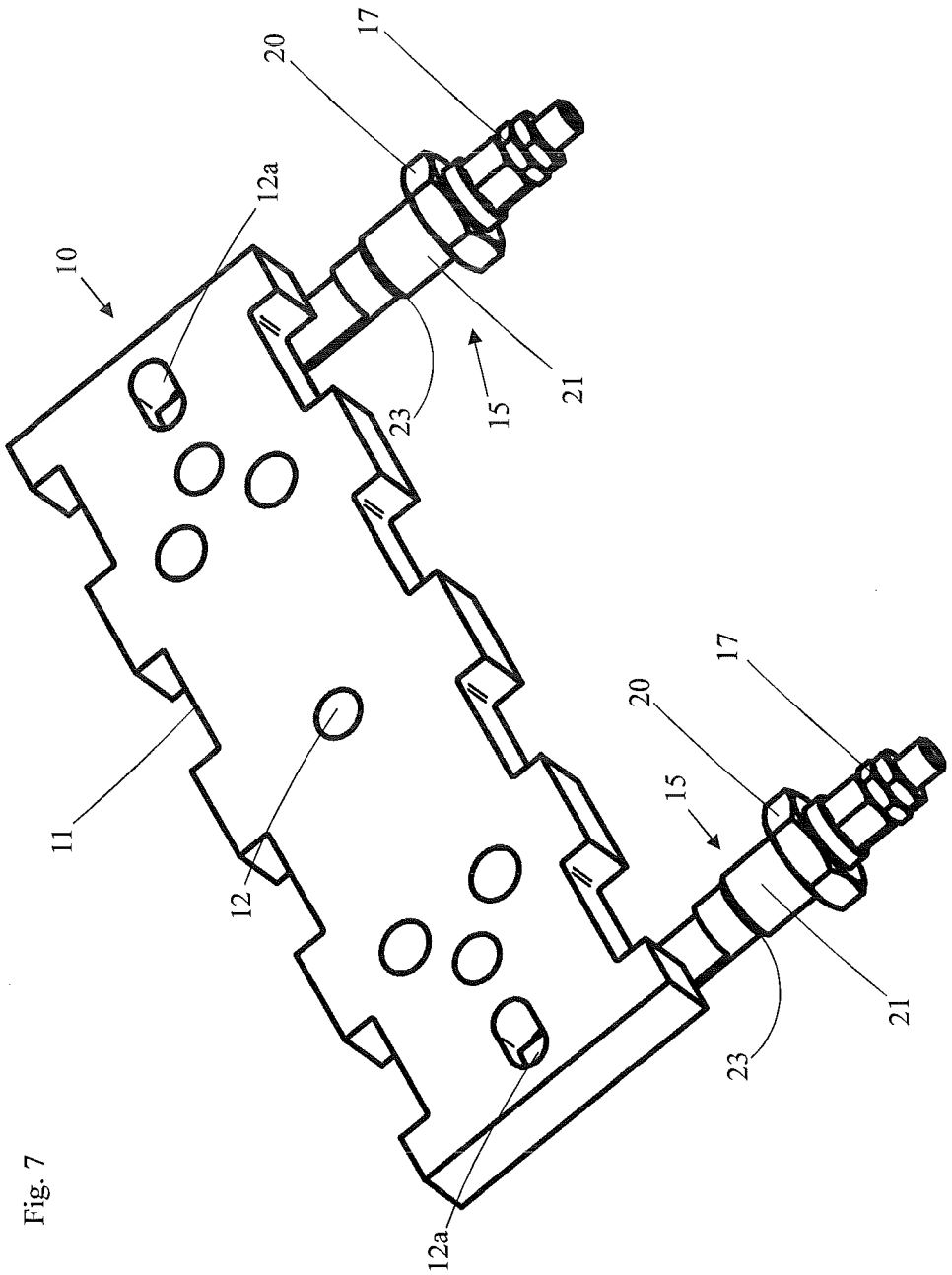


Fig. 7

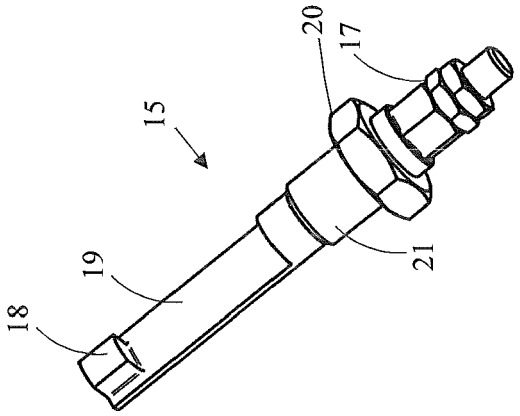


Fig. 9

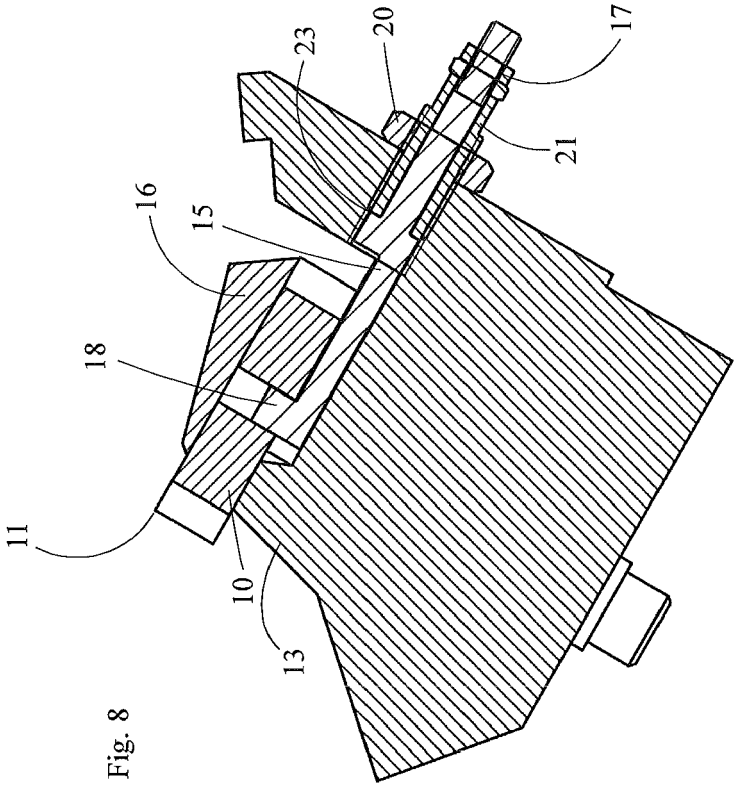


Fig. 8

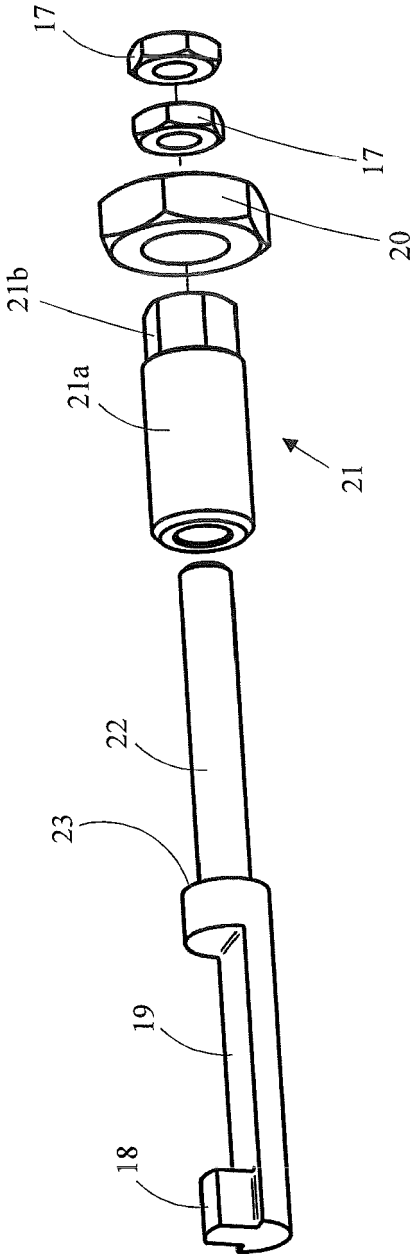


Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 16 16 6441

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	28 September 2016	Flodström, Benny

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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