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(54) **COIL LAYING HEAD**

SPULENSCHICHTKOPF

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Description

Field of the invention

[0001] The present invention relates to a coil laying head for continuous and substantially rectilinear semi-finished products coming from the mill or other similar source, such as wire rods, round rods or others.

Background art

[0002] A commonly used solution to obtain coils from metal wires of different diameter is to use a coil laying head comprising a rotor in which a coil forming and laminate conveyor tube is mounted. The rotor is mounted cantilevered on a stator body by means of two rolling bearings or supports, and can thus rotate around its own axis. The stator body is in turn rigidly constrained to a base. The rotor rotates about its own axis generally at high angular speeds, which can exceed 2000 RPM. The rotation of the rotor is generated by an external motor connected by a bevel gear driving system. Types of coil laying heads are also known where the rotors include internally the motor and coaxially mount the motor stator.

[0003] The laminate, during the rotation of the coil laying head, is bent by the tube to form a sequence of coils having a predefined diameter, which are deposited by dropping on a roller discharge belt to be cooled and conveyed to the collecting and stacking well.

[0004] Upon the passage of the metal wire, the coil forming tube is subjected to strong mechanical and thermal stresses, shocks and tangential thrusts which determine particularly strong wear conditions inside the tube which limit the lifespan thereof. Moreover, the wear undergone by the tube is often not uniform over its entire length, tending to concentrate in certain areas of greater stress rather than others. The replacement of the entire tube when at least a part thereof is worn therefore implies a non-optimal use of those parts that are not yet worn.

[0005] Moreover, a frequent replacement of such a tube causes downtime resulting in a reduced utilization factor of the plant and lack of productivity, in addition to resulting in high costs for spares and labor.

[0006] Moreover, the high centrifugal stresses undergone by the coil laying tube deform it, changing the initial geometric configuration thereof and, therefore, the machine becomes unbalanced. This fact precludes the possibility to further increase the rotation speed of the coil laying head as would be required by modern rolling mills which achieve rolling speeds that in the past could not be obtained.

[0007] Therefore, in order to overcome these drawbacks, both solutions which increase the tube duration through the use of wear resistant and interchangeable tubular inserts, and solutions that provide for the elimination of the tube itself, have been proposed. For example, with reference to the latter case, document EP-A-779 115 describes a coil laying head which in place of the coil laying tube uses a spiral-shaped conveying groove formed between two bell-shaped rotating members, one internal and one external, integral to each other and secured to the mandrel by a flange. The head is provided with four or more grooves which can be used alternately for conveying and guiding the laminate within the coil laying head.

[0008] The two bells are generally made of lightweight materials, such as light alloys or composite materials, which allow achieving high rotation speeds. To extend the useful lifespan, the grooves are coated with wear-resistant material.

[0009] Document U.S. 6098909 describes a solution similar to that of the previous document in which it is suggested to periodically rotate the inner bell with respect to the external one as a function of the local wear that occurs on the inner surface of the latter in order to restore the groove.

[0010] However, such solutions are not satisfactory because the bell-shaped member, which has the groove in which the product flows, must be frequently replaced due to the considerable wear caused by the passage of the laminate at a high speed.

Summary of the invention

[0011] The object of the present invention is to provide a coil laying head provided with a rotor which allows reducing the number of changes required in the grooved bell due to wear of the grooves, and the waste of material for making said grooved bell, thereby reducing the utilization cost of the object.

[0012] A further object of the present invention is to provide a coil laying head provided with a rotor which allows using each part of the groove where the laminate passes, suitable to the grade of wear to which it is subjected.

[0013] Another object of the present invention is to provide a coil laying head provided with a rotor which allows using the entire outer surface of said grooved bell.

[0014] A further object of the present invention is to provide a coil laying head which requires an easy maintenance of the rotor, the latter consisting of relatively manageable and not too heavy parts.

[0015] The present invention therefore aims to achieve the above objects by implementing a coil laying head, defining a longitudinal axis, which according to claim 1 comprises a fixed supporting structure; a rotor, adapted to rotate about said longitudinal axis and rotatably fixed to said supporting structure; wherein the rotor comprises a bell-shaped member, which is expanded outwards with respect to said longitudinal axis and has an outer surface thereof provided with at least one spiral-shaped groove, for guiding the metal product; wherein feeding means for feeding the metal product to said at least one groove are provided; characterized in that said bell-shaped member consists of at least three stages mutually arranged in sequence along the longitudinal axis so that the outer

surfaces of said stages, provided with spiral-shaped grooves, jointly define the outer surface of the bell-shaped member and can be arranged, by turning at least one stage about said longitudinal axis, in at least one respectively relative angular position so as to define at least one continuous spiral-shaped path for said metal product along the entire outer surface of the bell-shaped member.

[0016] The rotor of the coil laying head of the invention advantageously comprises a substantially bell-shaped member made in stages: in fact, it consists of a plurality of stages or truncated-cone-shaped parts which, arranged in a sequence, form the grooved bell that allows the formation of coils.

[0017] Grooves are made on each stage of the bell-shaped member of the rotor. The first stage has a very small end diameter on the side of the feeding means for feeding the metal product, allowing the implementation of a small number of grooves. On the contrary, the number of grooves may increase in the next stages as the diameter of the cross section of the bell-shaped member increases. In the final stage, however, the grooves or channels are again in a small number, preferably equal to or twice the number of grooves of the first stage. This is because in said last stage the helix pitch of the grooves is reduced, resulting in an axial crowding of the grooves and thus making it geometrically impossible to increase the number thereof. The stages are arranged in a relative angular position to each other such as to create at least one continuous and complete spiral path for the rolled product.

[0018] With the solution of the invention, when the groove used is worn and it is therefore necessary to change it, it is sufficient to rotate the stages to make the rolled metal product move in a new groove provided in the outer surface of the bell-shaped member. Once all grooves provided on the first stage have been used, it is necessary to replace only this first part of the rotor and those stages that have the same number of grooves, while the stages that have a greater number of grooves can be rotated again for moving the laminate into a new groove.

[0019] The number of grooves provided on each stage is maximized based on the geometry of the stage, in order to use the whole surface of the bell-shaped member of the rotor as much as possible.

[0020] Advantageously, the numbers of grooves on the different stages have a greatest common divisor equal to the number of grooves provided on the first stage: this ensures that the replacement of the stages takes place in a calculated manner and a stage with a large number of grooves is replaced at a change of the first stage. Depending on the position taken by each stage and on stresses to which the relative grooves are subjected, the wear detected on different stages can be very different; in fact, the grooves of some stages may each have a double duration with respect to the grooves of other particularly stressed stages.

[0021] Worn grooves are generally visibly recognizable but in order to prevent having to move the product again in a groove already worn out, the management of the angular positions of the stages of the bell-shaped member is carried out by control means provided with suitable software, which also allows minimizing the relative rotations required between consecutive stages.

[0022] The angular position between two adjacent stages is advantageously fixed by means of a pin, which keeps the relative angular position between two consecutive stages of the bell-shaped member and allows identifying the "open" channels to be used and those "closed" which have no continuation in the next stage.

[0023] Summarizing, among the advantages of the invention are:

- optimum use of all the space available on the rotor surface;
- extension of the useful lifespan of the single stages;
- possibility of selectively replacing only the stages that have worn all the available grooves, with cost saving;
- improvement in the productivity and in the utilization factor of the system, reducing costs for spares and labor.

[0024] The dependent claims describe preferred embodiments of the invention.

Brief description of the drawings

[0025] Further features and advantages of the invention will appear more clearly from the detailed description of preferred but non exclusive embodiments of a coil laying head, shown by way of a non-limiting example with the aid of the accompanying drawing tables, in which:

Figure 1 shows a diagrammatic cross section view of a coil laying head according to the invention;
Figure 2 shows an exploded side view of a component of a variant of the coil laying head in Figure 1;
Figure 3 shows a first perspective view of the component in Figure 2;
Figure 4 shows a second perspective view of the component in Figure 2.

[0026] For ease of reading, the bearings visible in Figure 1 are represented by an X inscribed in a rectangle.

[0027] The same reference numerals and letters in the figures identify the same elements or components.

Detailed description of preferred embodiments of the invention

[0028] With reference to Figure 1, the coil laying head object of the present invention is diagrammatically shown according to a cross section along a plane passing by the longitudinal axis X.

[0029] The coil laying head includes:

- a fixed supporting structure 3,
- and a rotor 1, adapted to rotate about said longitudinal axis X and rotatably fixed to said supporting structure 3.

[0030] Rotor 1 in turn comprises a mandrel 4 and a bell-shaped member 6, having a substantially truncated-cone shape, which expands outwards with respect to the longitudinal axis X and axially cooperates with mandrel 4. The bell-shaped member 6 is provided on its outer surface with a plurality of grooves or channels, substantially spiral-shaped, for guiding the metal product to the coil formation.

[0031] In particular, mandrel 4, having a hollow cylindrical shape, is stably connected by means of mechanical coupling to the bell-shaped member 6 according to axis X. The bell-shaped member 6 fits in mandrel 4 by an initial stretch and is inserted in a housing 2 having a shape matching the shape of said member 6. In the example in Figure 1, housing 2 has a truncated-cone inner shape. Housing 2 is integral with base or casing 3 of the coil laying head and is therefore fixed, i.e. not rotating. A limited gap, for example of at least 1 mm, is left between the bell-shaped member 6 and housing 2, in general sufficient to allow a relative rotation of the bell-shaped member 6 about axis X without causing interference or sliding against housing 2. Preferably, such a gap is lower than the thickness of the laminate.

[0032] According to a preferred variant, housing 2 may be openable so as to allow access to the bell-shaped member 6.

[0033] According to another variant, housing 2 may be sliding along axis X with respect to the bell-shaped member 6 to vary the gap between housing 2 and the bell-shaped member itself.

[0034] Mandrel 4 rotates inside casing 3, fixed to the ground. Mandrel 4 is rotatably associated with said casing 3 by means of bearings. Casing 3 may be entirely monolithic with housing 2.

[0035] Mandrel 4 contains internally feeding means 5 for feeding the metal product to at least one of the grooves provided on the bell-shaped member 6.

[0036] Such feeding means 5 for example comprise a selector tube arranged coaxially to the rotor and provided with an inner conduit 5' for guiding the rolled product to the entrance of a respective groove on the bell-shaped member 6. The inner conduit 5' has an inlet stretch for receiving the rolled product, which enters the head along axis X. Such an inner conduit 5' has an exit stretch that diverges from axis X to guide the rolled product at the entrance of one of the grooves on the bell-shaped member 6.

[0037] A main control connected with mandrel 4 is provided for driving the bell-shaped member 6 in rotation about axis X, for example by means of a reduction gear or equivalent means. The selector tube always rotates synchronously with bell-shaped member 6 and mandrel 4 during the passage of the laminate, so as to continuously ensure the alignment between the outlet stretch of the inner conduit 5' and one of the grooves provided on the bell-shaped member 6. The selector tube can preferably receive the motion from the same mandrel 4, for example by means of a differential phaser system.

[0038] Further components and details of the coil laying head are omitted as they are not essential for describing the invention.

[0039] Advantageously, the bell-shaped member 6 is made in at least three substantially truncated-cone stages arranged joined and in a sequence along the longitudinal axis X so that the outer surfaces thereof, provided with spiral-shaped grooves, together define the outer surface of member 6. Moreover, advantageously, the group of the numbers of spiral-shaped grooves of each stage has a greatest common divisor which is equal to the number of spiral-shaped grooves 7', named first number, of a first end stage 7 of the bell-shaped member 6, proximal to the feeding means 5.

[0040] A second end stage 11, distal from said feeding means 5, is provided, on an outer surface thereof, with a second number of spiral-shaped grooves 11', either equal to or multiple of said first number of grooves 7'. Said second end stage 11 of the bell-shaped member 6 has a substantially cylindrical end stretch where said second number of spiral-shaped grooves 11' follows approximately an angle of 360°, and wherein it is preferable that the number of grooves 11' is small, for example equal to or at most twice the number of grooves 7', since said grooves must preferably have a very small pitch.

[0041] At least one intermediate stage is also provided, arranged between said first end stage 7 and second end stage 11 and provided with a respective number of spiral-shaped grooves on the outer surface thereof which advantageously is a multiple of said first number of grooves 7'.

[0042] The number of grooves of two adjacent stages can advantageously be different, in particular in the case where it is geometrically possible to make a suitable number of grooves on the two stages, or it can equally advantageously be the same if for example the grooves of the two stages, due to their position, undergo different wear and therefore have different lifespan.

[0043] Angular positioning means are provided for adjusting the angular position of one stage with respect to the next one. In a possible variant, said angular positioning means are represented by at least one connecting pin 20, provided in at least one of two adjacent stages constituting the bell-shaped member 6.

[0044] In a first preferred embodiment of the invention, the bell-shaped member 6 consists of five substantially truncated-cone stages: the two end stages 7, 11 and three intermediate stages 8, 9, 10. The number of grooves 7', named first number, is equal to the number of grooves 11', while the number of grooves provided on the intermediate stages 8, 9, 10 is different from one an-

other and is also a multiple of the number of grooves 7'.

[0045] In particular, in a sequence along axis X, the first intermediate stage 8 has a third number of grooves 8' which is triple of said first number, the second intermediate stage 9 has a fourth number of grooves 9' which is double of said third number, and the third intermediate stage 10 has a fifth number of grooves 10' which is triple of said third number.

[0046] In the variant shown in Figures 2 to 4, there are provided four grooves 7' in the first end stage 7, twelve grooves 8' in the first intermediate stage 8, twenty-four grooves 9' in the second intermediate stage 9, thirty-six grooves 10' in the third intermediate stage 10, and four grooves 11' in the second end stage 11. In this case, four is the greatest common divisor of the numbers of grooves provided in each of said five stages.

[0047] Other variants may include a first number of grooves 7' equal to three or five, which will therefore be the greatest common divisor of the numbers of grooves provided in each of the five stages.

[0048] In a second preferred embodiment of the invention (not shown), the bell-shaped member 6 consists of six substantially truncated-cone stages: the two end stages and four intermediate stages.

[0049] In a first variant of said second embodiment, the number of grooves 7' of the first end stage 7, named first number, is equal to the number of grooves 11' of the second end stage 11, while the number of grooves is different between an intermediate stage and the next one and is a multiple of said first number of grooves 7'. An advantageous variant provides that, in succession, the first and the third intermediate stages have an equal number of grooves, while the second and the fourth intermediate stages have a number of grooves which is different from each other and also different from the number of grooves of the first and third intermediate stages. In particular, the second intermediate stage may have a number of grooves twice the number of grooves of the first intermediate stage, and the fourth intermediate stage may have a number of grooves triple the number of grooves of said first intermediate stage.

[0050] In an advantageous example, in a sequence along axis X, there are provided four grooves in the first end stage, twelve grooves in the first intermediate stage, twenty-four grooves in the second intermediate stage, twelve grooves in the third intermediate stage, thirty-six grooves in the fourth intermediate stage and four grooves in the second end stage. Also in this example, four is the greatest common divisor of the numbers of grooves provided in each of said six stages.

[0051] In a second variant of said second embodiment, the number of grooves 7' of the first end stage 7, named first number, is equal to the number of grooves 11' of the second end stage 11, while the number of grooves is different or equal between an intermediate stage and the next one and is a multiple of said first number of grooves 7'. An advantageous variant provides that, in succession, the second and the third intermediate stages have an equal number of grooves, while the first and the fourth intermediate stages have a number of grooves which is different from each other and also different from the number of grooves of the second and third intermediate stages. In particular, the fourth intermediate stage may have a number of grooves triple the number of grooves of the first intermediate stage, and the second and the third intermediate stages may have a number of grooves twice the number of grooves of said first intermediate stage.

[0052] In an advantageous example, in a sequence along axis X, there are provided four grooves in the first end stage, twelve grooves in the first intermediate stage, twenty-four grooves in the second and in the third intermediate stages, thirty-six grooves in the fourth intermediate stage and four grooves in the second end stage. Also in this example, four is the greatest common divisor of the numbers of grooves provided in each of said six stages.

[0053] In a third preferred embodiment of the invention (not shown), the bell-shaped member 6 consists of four substantially truncated-cone stages: the two end stages 7, 11 and two intermediate stages. The number of grooves 7', named first number, is equal to the number of grooves 11', while the number of grooves provided on the two intermediate stages is different from one another and is a multiple of the number of grooves 7'.

[0054] All the spiral grooves provided in the different stages constituting the bell-shaped member 6 are open outwards and have a cross-sectional dimension which is a function of the diameter of the rolled product to be wound into coils.

[0055] The elements and the features shown in the different preferred embodiments may be combined without departing from the scope of protection of the present application.

Claims

1. A coil laying head, defining a longitudinal axis (X), for forming coils of a substantially rectilinear metal product, comprising

- a fixed supporting structure (3),
- a rotor (1), adapted to rotate about said longitudinal axis (X) and rotatably fixed to said supporting structure (3),

wherein the rotor (1) comprises a bell-shaped member (6), which expands outwards with respect to said longitudinal axis (X) and has an outer surface thereof provided with at least one spiral-shaped groove, for guiding the metal product,

wherein feeding means (5) for feeding the metal product to said at least one groove are provided,

characterized in that said bell-shaped member (6) consists of at least three stages mutually arranged

in sequence along the longitudinal axis (X) so that the outer surfaces of said stages, provided with spiral-shaped grooves, jointly define the outer surface of the bell-shaped member (6) and can be arranged, by turning at least one stage about said longitudinal axis (X), in at least one respectively relative angular position so as to define at least one continuous spiral-shaped path for said metal product along the entire outer surface of the bell-shaped member (6).

2. A coil laying head according to claim 1, wherein the group of the numbers of spiral-shaped grooves of each stage has a greatest common divisor.

3. A coil laying head according to claim 2, wherein said greatest common divisor is equal to the number of spiral-shaped grooves (7'), named first number, of a first end stage (7) of the bell-shaped member (6), proximal to said feeding means (5).

4. A coil laying head according to claim 3, wherein a second end stage (11) distal from said feeding means (5) is provided, on an outer surface thereof, with a second number of spiral-shaped grooves (11'), either equal to or multiple of said first number, and wherein at least one intermediate stage (8, 9, 10), arranged between said first end stage and said second end stage, is provided on an outer surface thereof with a respective number of spiral-shaped grooves (8', 9', 10') which is multiple of the first number.

5. A coil laying head according to claim 1, wherein angular positioning means are provided for adjusting the angular position of one stage with respect to the next one.

6. A coil laying head according to claim 5, wherein said angular positioning means are at least one connection pin (20) provided in at least one of two adjacent stages.

7. A coil laying head according to any one of the preceding claims, wherein said outer surface of the bell-shaped member (6) is substantially truncated-cone-shaped.

8. A coil laying head according to claim 4, wherein said second end stage (11) of the bell-shaped member (6) has a substantially cylindrical end segment where said second number of spiral-shaped grooves (11') follows approximately an angle of 360°.

9. A coil laying head according to claim 4 or 8, wherein three intermediate stages (8, 9, 10) are provided in sequence, with a number of grooves which is mutually different but multiple of said first number.

10. A coil laying head according to claim 9, wherein a first intermediate stage (8) has a third number of grooves (8') which is triple of said first number, a second intermediate stage (9) has a fourth number of grooves (9') which is double of said third number, and a third intermediate stage (10) has a fifth number of grooves (10') which is triple of said third number.

11. A coil laying head according to claim 4 or 8, wherein four intermediate stages are provided in sequence, and wherein one of said intermediate stages and the next one have a number of grooves either different or equal to each other, but multiple of said first number.

12. A coil laying head according to claim 11, wherein a first intermediate stage and a third intermediate stage have a third number of grooves, while a second intermediate stage and a fourth intermediate stage have a number of grooves which is mutually different and is also different from said third number.

13. A coil laying head according to claim 12, wherein the second intermediate stage has a fourth number of grooves which is double of said third number, and the fourth intermediate stage has a fifth number of grooves which is triple of said third number.

14. A coil laying head according to claim 11, wherein a second intermediate stage and a third intermediate stage have a third number of grooves, while a first intermediate stage and a fourth intermediate stage have a number of grooves which is mutually different and is also different from said third number.

15. A coil laying head according to claim 14, wherein the fourth intermediate stage has a fourth number of grooves which is triple of the number of grooves of the first intermediate stage, while said third number of grooves is double of the number of grooves of said first intermediate stage.

16. A coil laying head according to claim 4 or 8, wherein there are
provided two intermediate stages with a mutually different number of grooves which is multiple of said first number.

17. A coil laying head according to any one of the preceding claims, wherein the bell-shaped member (6) coaxially cooperates with a mandrel (4) containing internally said feeding means (5).

Patentansprüche

1. Windungslegekopf, der eine Längsachse (X) definiert, zum Formen von Windungen aus einem im

Wesentlichen geraden Metallprodukt, aufweisend:

- eine feststehende Tragstruktur (3)
- einen Rotor (1), der um die Längsachse (X) rotieren kann und drehbar auf der Tragstruktur (3) befestigt ist,

wobei der Rotor ein glockenförmiges Element (6) aufweist, das sich gegenüber der Längsachse (X) nach außen erstreckt und eine äußere Oberfläche aufweist, die dort mit mindestens einer spiralförmigen Nut versehen ist, um das Metallprodukt zu führen, wobei Zuführungsmittel (5) vorgesehen sind, um das Metallprodukt zu der mindestens einen Nut zu führen, **dadurch gekennzeichnet, dass**
das glockenförmige Element (6) aus mindestens drei hintereinander angeordneten Stufen entlang der Längsachse (X) besteht, so dass die äußeren Oberflächen der Stufen, die mit spiralförmigen Nuten versehen sind, zusammen die äußere Oberfläche des glockenförmigen Elements (6) definieren und durch Drehung mindestens einer Stufe um die Längsachse (X) in eine entsprechende, relative Drehposition so angeordnet werden können, dass mindestens ein kontinuierlicher spiralförmiger Pfad für das Metallprodukt entlang der gesamten äußeren Oberfläche des glockenförmigen Elements (6) definiert wird.

2. Windungslegekopf gemäß Anspruch 1, wobei die Anzahl der spiralförmigen Nuten einer jeden Stufe einen größten gemeinsamen Teiler hat.

3. Windungslegekopf gemäß Anspruch 2, wobei der größte gemeinsame Teiler gleich der Anzahl von Nuten (7') - erste Anzahl genannt - einer ersten Endstufe (7) des glockenförmigen Elements (6) ist, die dem Zuführungsmittel (5) am nächsten ist.

4. Windungslegekopf gemäß Anspruch 3, wobei eine zweite Endstufe (11) distal des Zuführungsmittels (5) an einer äußeren Oberfläche hiervon vorgesehen ist, mit einer zweiten Anzahl von spiralförmigen Nuten (11'), die entweder gleich der ersten Anzahl oder ein Vielfaches davon ist,
und wobei mindestens eine zwischen der ersten Endstufe und der zweiten Endstufe angeordnete Zwischenstufe (8, 9, 10) an einer äußeren Oberfläche vorgesehen ist, mit einer entsprechenden Anzahl von spiralförmigen Nuten (8', 9', 10'), die ein Vielfaches der ersten Anzahl ist.

5. Windungslegekopf gemäß Anspruch 1, wobei Mittel zur Winkelpositionierung vorgesehen sind, um die Drehposition einer Stufe bezüglich der nächsten einzustellen.

6. Windungslegekopf gemäß Anspruch 5, wobei die Mittel zur Winkelpositionierung aus mindestens einem Verbindungsstift (20) besteht, der in mindestens einer von zwei benachbarten Stufen vorgesehen ist.

7. Windungslegekopf gemäß einem der vorigen Ansprüche, wobei die äußere Oberfläche des glockenförmigen Elements (6) im Wesentlichen die Form eines Kegelstumpfes hat.

8. Windungslegekopf gemäß Anspruch 4, wobei die zweite Endstufe (11) des glockenförmigen Elements (6) ein im Wesentlichen zylindrisches Endsegment aufweist, dessen zweite Anzahl von spiralförmigen Nuten (11') in etwa einem Winkel von 360° folgt.

9. Windungslegekopf gemäß Anspruch 4 oder 8, wobei drei Zwischenstufen (8, 9, 10) hintereinander vorgesehen sind, deren Anzahl von Nuten unterschiedlich, aber ein Vielfaches der ersten Anzahl ist.

10. Windungslegekopf gemäß Anspruch 9, wobei eine erste Zwischenstufe (8) eine dritte Anzahl von Nuten (8') aufweist, die das dreifache der ersten Anzahl beträgt, eine zweite Zwischenstufe (9) eine vierte Anzahl von Nuten (9') aufweist, die das doppelte der dritten Anzahl beträgt, und eine dritte Zwischenstufe (10) eine fünfte Anzahl von Nuten (10') aufweist, die das dreifache der dritten Anzahl beträgt.

11. Windungslegekopf gemäß Anspruch 4 oder 8, wobei vier Zwischenstufen hintereinander vorgesehen sind, und wobei eine der Zwischenstufen und die Darauffolgende entweder eine unterschiedliche oder die gleiche Anzahl von Nuten aufweisen, jedoch ein Vielfaches der ersten Anzahl.

12. Windungslegekopf gemäß Anspruch 11, wobei eine erste Zwischenstufe und eine dritte Zwischenstufe eine dritte Anzahl von Nuten aufweisen, während eine zweite Zwischenstufe und eine vierte Zwischenstufe eine zueinander unterschiedliche Anzahl von Nuten aufweisen, die zudem unterschiedlich zur dritten Anzahl ist.

13. Windungslegekopf gemäß Anspruch 12, wobei die zweite Zwischenstufe eine vierte Anzahl von Nuten aufweist, die das doppelte der dritten Anzahl beträgt, und die vierte Zwischenstufe eine fünfte Anzahl von Nuten aufweist, die das dreifache der dritten Anzahl beträgt.

14. Windungslegekopf gemäß Anspruch 11, wobei eine zweite Zwischenstufe und eine dritte Zwischenstufe eine dritte Anzahl von Nuten aufweisen, während eine erste Zwischenstufe und eine vierte Zwischenstufe eine zueinander unterschiedliche Anzahl von Nuten aufweisen, die zudem unterschiedlich zur dritten Anzahl ist.

15. Windungslegekopf gemäß Anspruch 14, wobei die vierte Zwischenstufe eine vierte Anzahl von Nuten aufweist, die das dreifache der Anzahl der Nuten der ersten Zwischenstufe beträgt, während die dritte Anzahl der Nuten das doppelte der Anzahl der Nuten der ersten Zwischenstufe beträgt.

16. Windungslegekopf gemäß Anspruch 4 oder 8, wobei zwei Zwischenstufen vorgesehen sind, die eine zueinander unterschiedliche Anzahl von Nuten aufweisen, die ein Vielfaches der ersten Anzahl betragen.

17. Windungslegekopf gemäß einem der vorigen Ansprüche, wobei das glockenförmige Element (6) koaxial mit einem Dorn (4) zusammenwirkt, der innen die Zuführungsmittel (5) aufweist.

Revendications

1. Tête de posage de bobine, définissant un axe longitudinal (X), pour former des bobines d'un produit de métal sensiblement rectiligne, comprenant

- une structure de support fixe (3),
- un rotor (1), adapté pour tourner autour dudit axe longitudinal (X), et fixé avec faculté de rotation à ladite structure de support (3),

dans laquelle le rotor (1) comprend un organe en forme de cloche (6), qui se déploie vers l'extérieur par rapport audit axe longitudinal (X) et dont une surface externe est pourvue d'au moins une rainure en forme de spirale, pour guider le produit de métal, dans laquelle des moyens d'alimentation (5) sont prévus pour alimenter ladite au moins une rainure en le produit de métal,
caractérisée en ce que ledit organe en forme de cloche (6) consiste en au moins trois étages mutuellement agencés en séquence le long de l'axe longitudinal (X) pour que les surfaces externes desdits étages, pourvues de rainures en forme de spirale, définissent conjointement la surface externe de l'organe en forme de cloche (6) et peuvent être agencées, en tournant d'au moins un étage autour dudit axe longitudinal (X), dans au moins une position angulaire respectivement relative de manière à définir au moins un chemin en forme de spirale continu pour ledit produit de métal le long de la surface externe entière de l'organe en forme de cloche (6).

2. Tête de posage de bobine selon la revendication 1, dans laquelle le groupe des nombres de rainures en forme de spirale de chaque étage a un plus grand diviseur commun.

3. Tête de posage de bobine selon la revendication 2, dans laquelle ledit plus grand diviseur commun est égal au nombre de rainures en forme de spirale (7'), appelé premier nombre, d'un premier étage d'extrémité (7) de l'organe en forme de cloche (6), à proximité desdits moyens d'alimentation (5).

4. Tête de posage de bobine selon la revendication 3, dans laquelle un second étage d'extrémité (11) à distance desdits moyens d'alimentation (5) est doté, sur une surface externe de celui-ci, d'un deuxième nombre de rainures en forme de spirale (11'), soit égal audit, soit un multiple dudit premier nombre,
et dans laquelle au moins un étage intermédiaire (8, 9, 10), agencé entre ledit premier étage d'extrémité et ledit second étage d'extrémité, est doté sur une surface externe de celui-ci, d'un nombre respectif de rainures en forme de spirale (8', 9', 10') qui est un multiple du premier nombre.

5. Tête de posage de bobine selon la revendication 1, dans laquelle des moyens de positionnement angulaire sont prévus pour ajuster la position angulaire d'un étage par rapport au suivant.

6. Tête de posage de bobine selon la revendication 5, dans laquelle lesdits moyens de positionnement angulaire sont au moins un pion de raccordement (20) ménagé dans au moins l'un de deux étages adjacents.

7. Tête de posage de bobine selon l'une quelconque des revendications précédentes, dans laquelle ladite surface externe de l'organe en forme de cloche (6) est sensiblement en forme de cône tronqué.

8. Tête de posage de bobine selon la revendication 4, dans laquelle ledit second étage d'extrémité (11) de l'organe en forme de cloche (6) a un segment d'extrémité sensiblement cylindrique où ledit deuxième nombre de rainures en forme de spirale (11') forme approximativement un angle de 360°.

9. Tête de posage de bobine selon la revendication 4 ou 8, dans laquelle trois étages intermédiaires (8, 9, 10) sont ménagés en séquence, avec un nombre de rainures qui est mutuellement différent, mais un multiple, dudit premier nombre.

10. Tête de posage de bobine selon la revendication 9, dans laquelle un premier étage intermédiaire (8) a un troisième nombre de rainures (8') qui est le triple dudit premier nombre, un deuxième étage intermédiaire (9) a un quatrième nombre de rainures (9') qui est le double dudit troisième nombre, et un troisième étage intermédiaire (10) a un cinquième nombre de rainures (10') qui est le triple dudit troisième nombre.

11. Tête de posage de bobine selon la revendication 4 ou 8, dans laquelle quatre étages intermédiaires sont

ménagés en séquence, et dans laquelle l'un desdits étages intermédiaires et le suivant ont un nombre de rainures soit différent soit égal l'un l'autre, mais un multiple dudit premier nombre.

12. Tête de posage de bobine selon la revendication 11, dans laquelle un premier étage intermédiaire et un troisième étage intermédiaire ont un troisième nombre de rainures, alors qu'un deuxième étage intermédiaire et un quatrième étage intermédiaire ont un nombre de rainures qui est mutuellement différent et est également différent dudit troisième nombre.

13. Tête de posage de bobine selon la revendication 12, dans laquelle le deuxième étage intermédiaire a un quatrième nombre de rainures qui est le double dudit troisième nombre, et le quatrième étage intermédiaire a un cinquième nombre de rainures qui est le triple dudit troisième nombre.

14. Tête de posage de bobine selon la revendication 11, dans laquelle un deuxième étage intermédiaire et un troisième étage intermédiaire ont un troisième nombre de rainures, alors qu'un premier étage intermédiaire et un quatrième étage intermédiaire ont un nombre de rainures qui est mutuellement différent et est également différent dudit troisième nombre.

15. Tête de posage de bobine selon la revendication 14, dans laquelle le quatrième étage intermédiaire a un quatrième nombre de rainures qui est le triple du nombre de rainures du premier étage intermédiaire, alors que ledit troisième nombre de rainures est le double du nombre de rainures dudit premier étage intermédiaire.

16. Tête de posage de bobine selon la revendication 4 ou 8, dans laquelle deux étages intermédiaires ayant un nombre mutuellement différent de rainures qui est un multiple dudit premier nombre sont ménagés.

17. Tête de posage de bobine selon l'une quelconque des revendications précédentes, dans laquelle l'organe en forme de cloche (6) coopère axialement avec un mandrin (4) contenant à l'intérieur lesdits moyens d'alimentation (5).

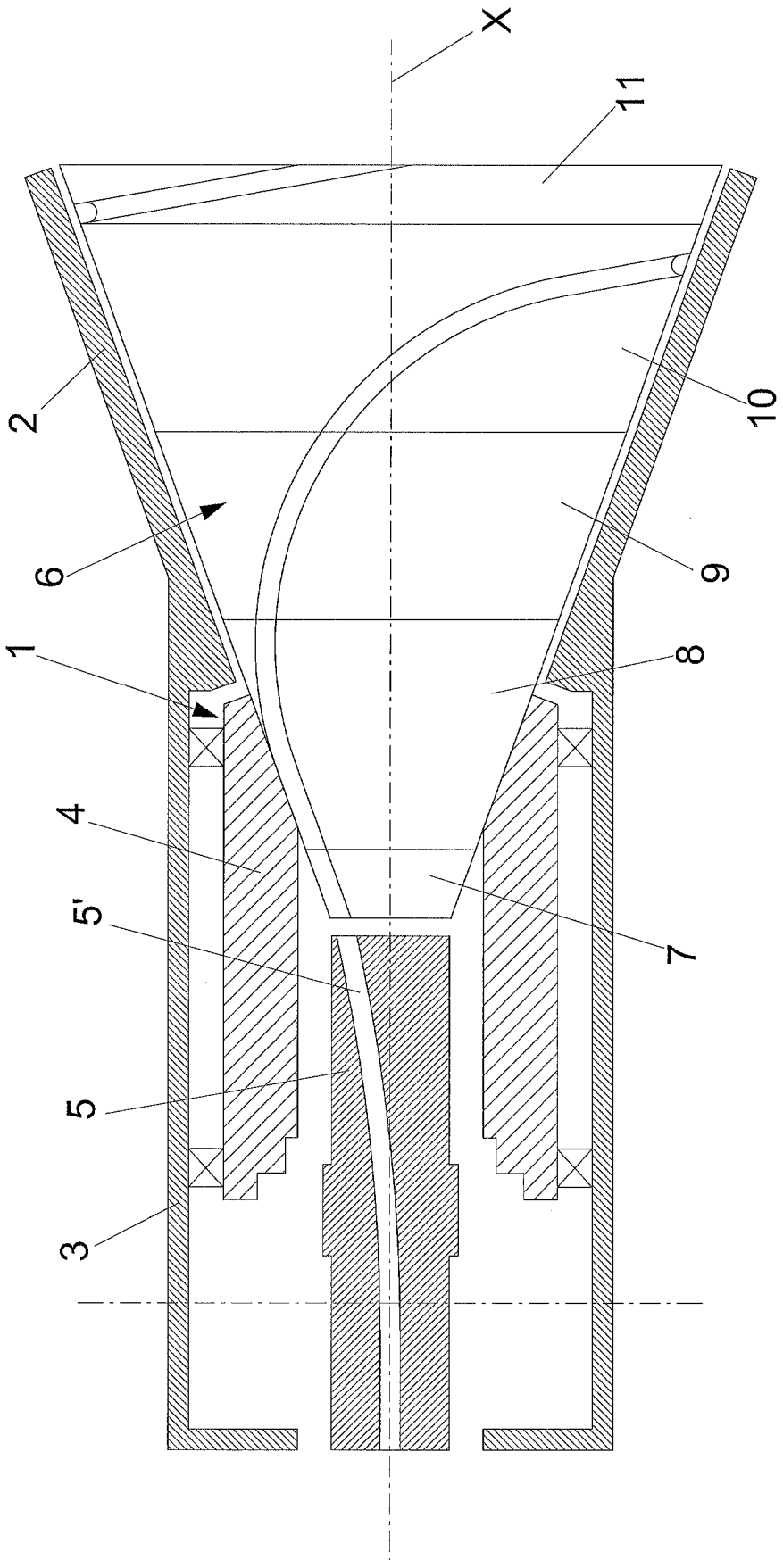

Fig. 1

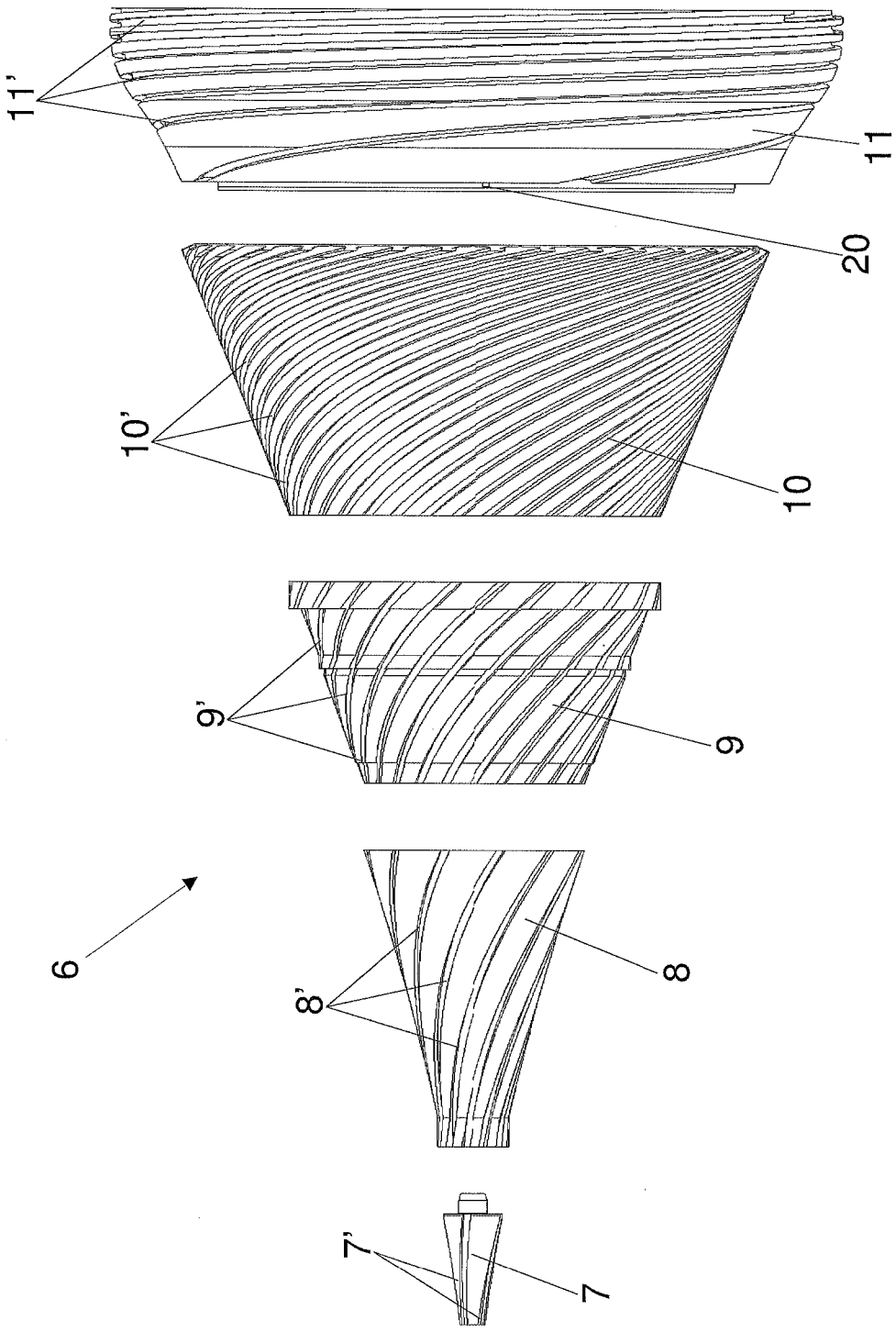

Fig. 2

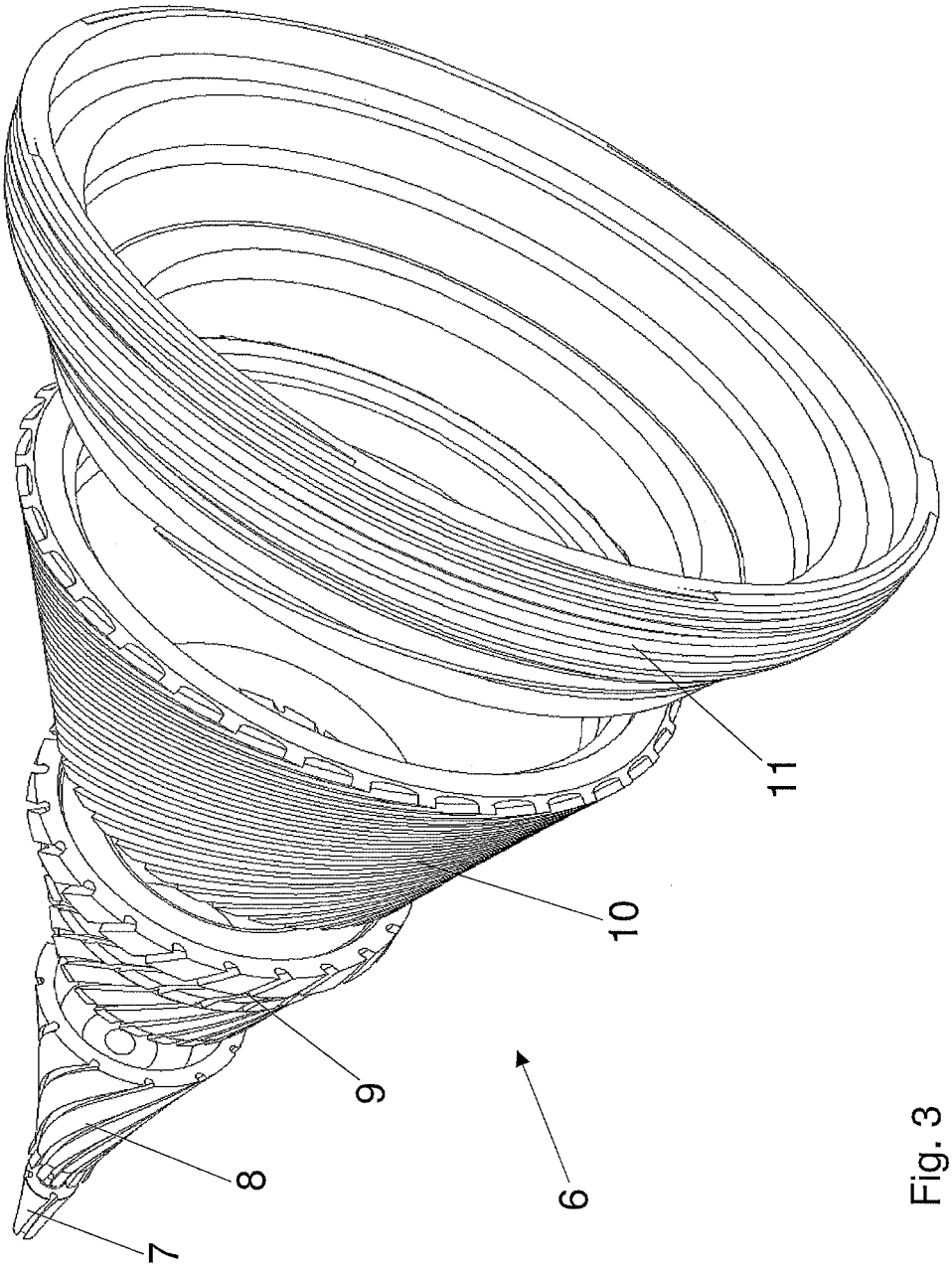

Fig. 3

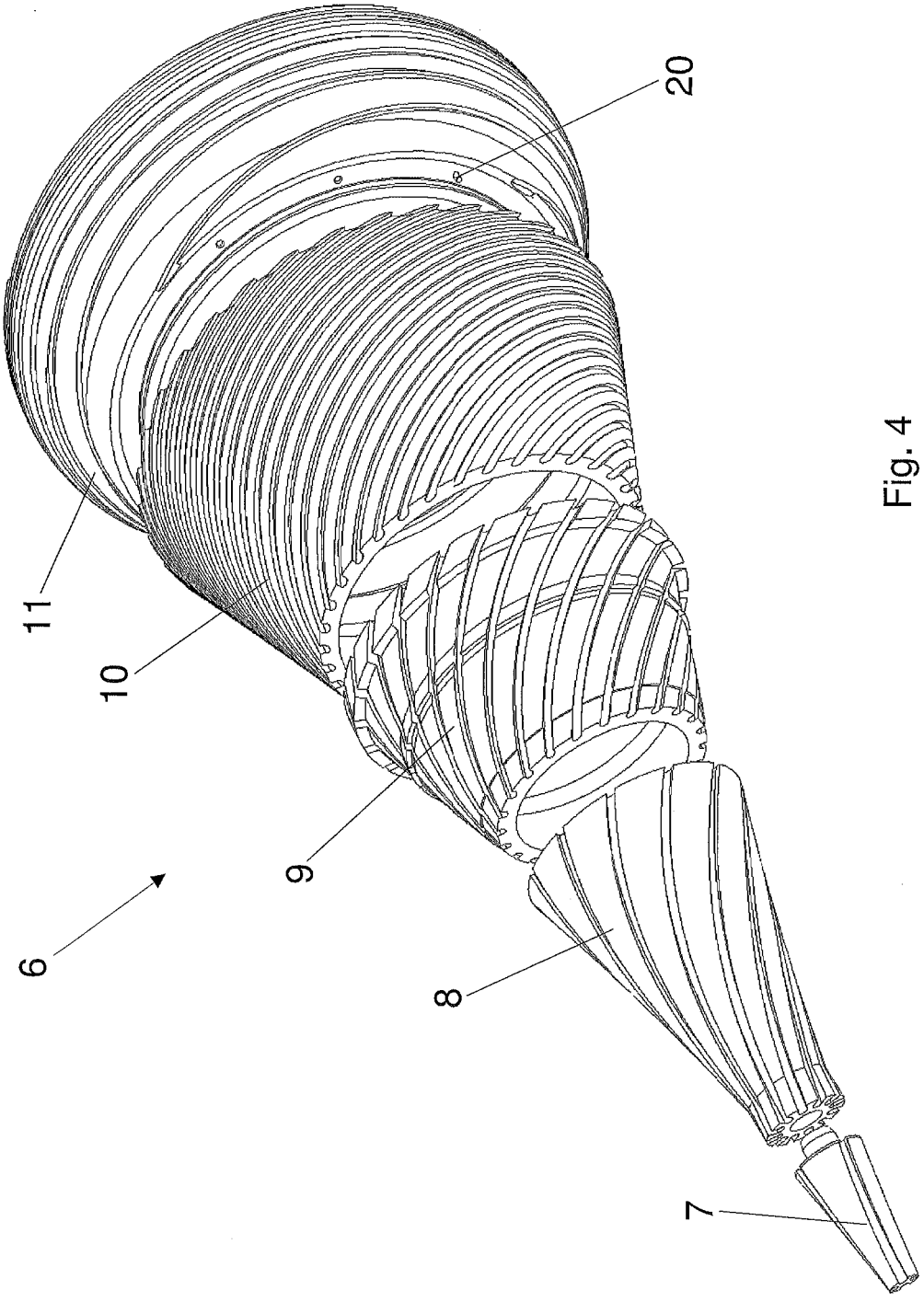

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- US 6098909 A **[0009]**