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(54) **ONE-PIECE JOINT BODY**

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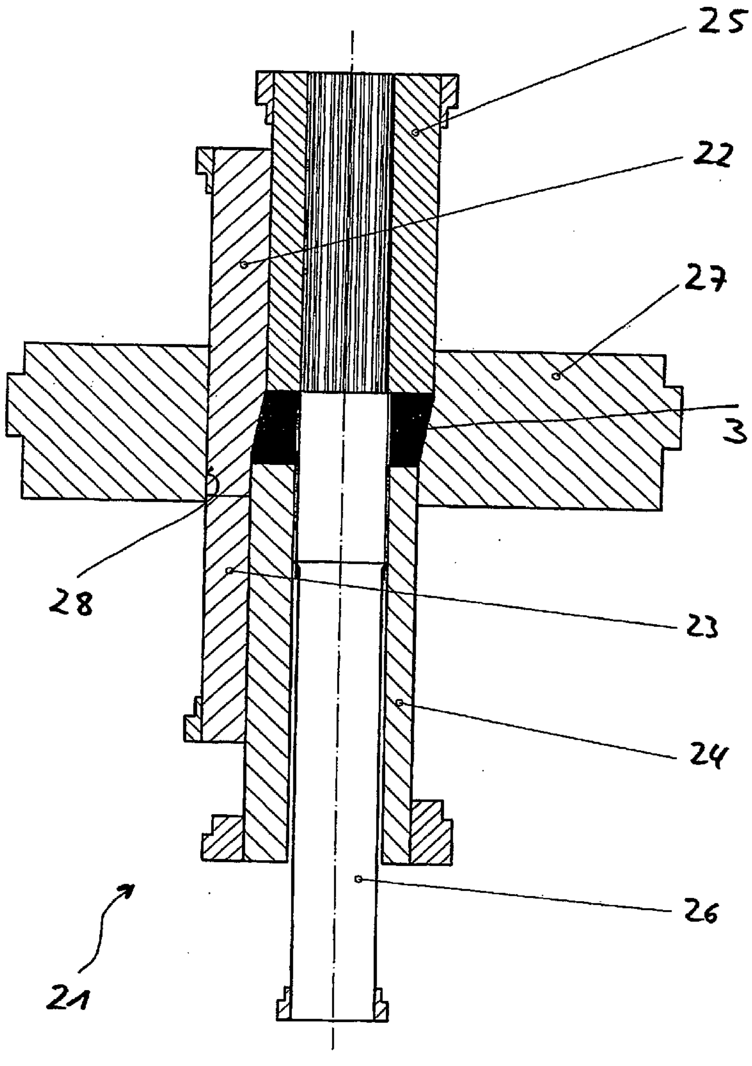
(57) **ABSTRACT**

The invention relates to a method for producing a metal component, in particular an internal joint part of a Cardan joint, which is provided with a ball path. According to the invention: a charge cavity is filled with powder; the charge cavity is delimited by means of a die, at least one molding mandrel and a charging mandrel positioned opposite the latter, a central mandrel and at least one lower and upper punch; the powder is compressed in the charge cavity by pressure on the upper and/or lower punch to form a green product, which is then expelled and sintered



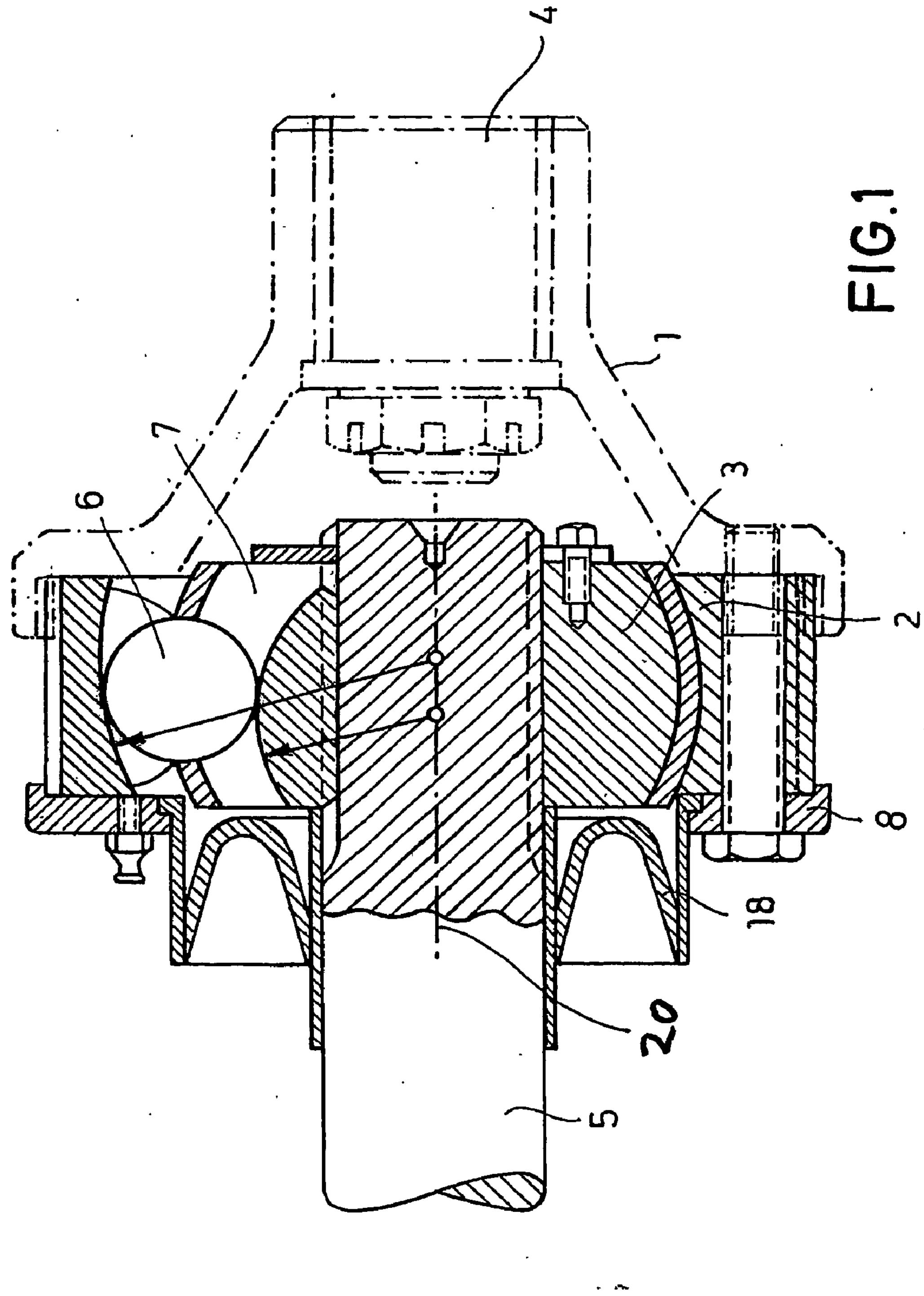


FIG.1

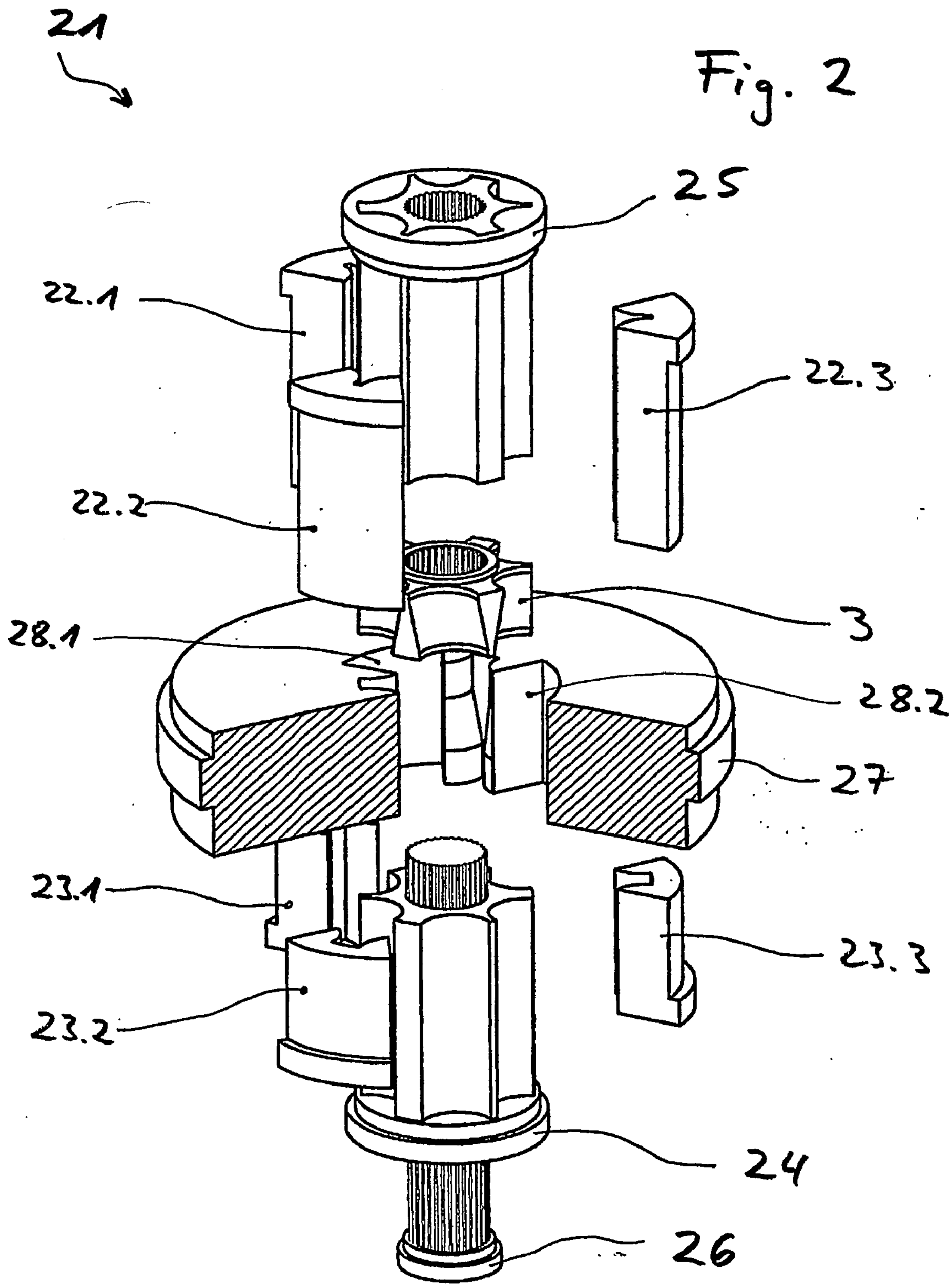

21
Fig. 2
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Fig. 3

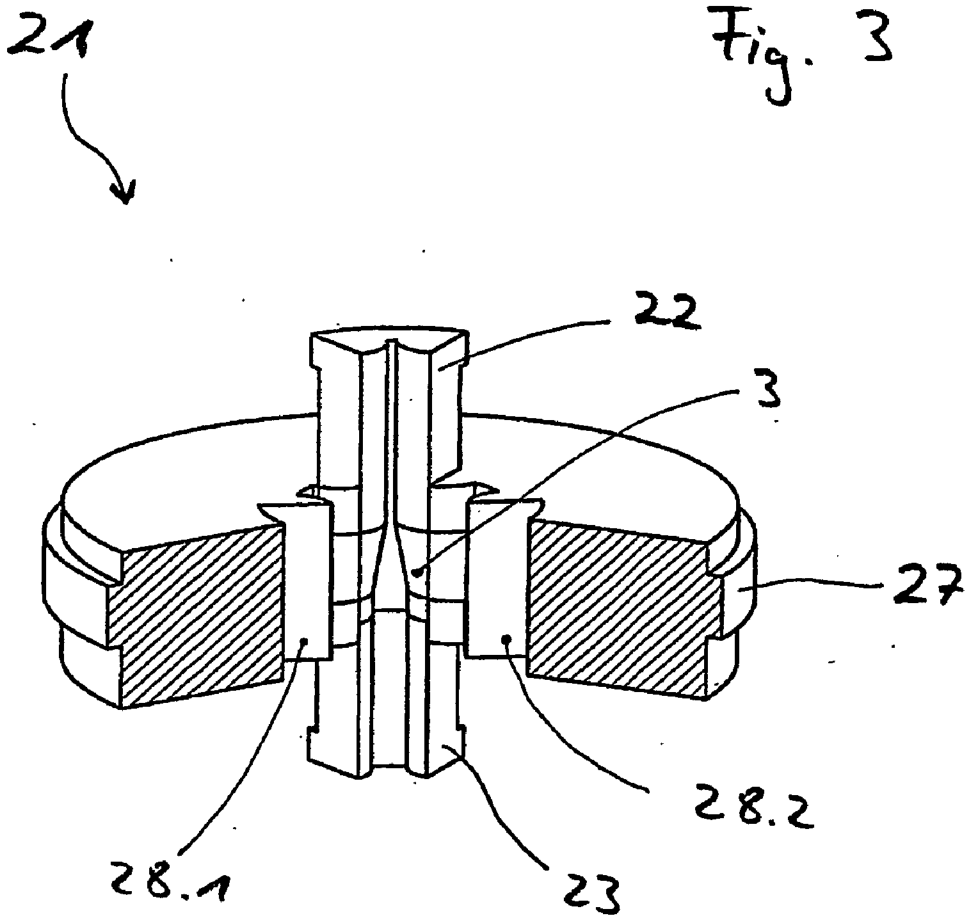


Fig. 4

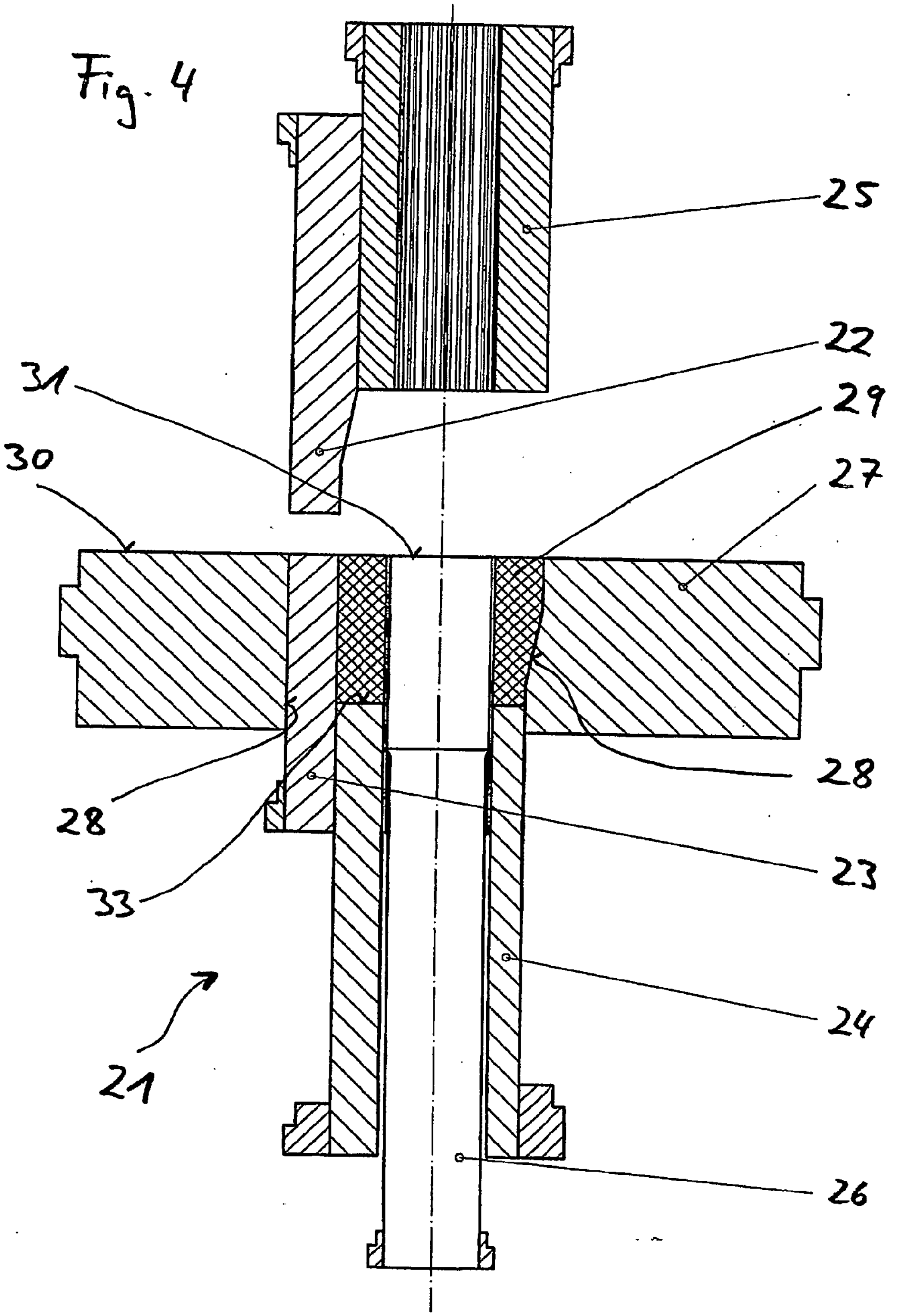


Fig. 5

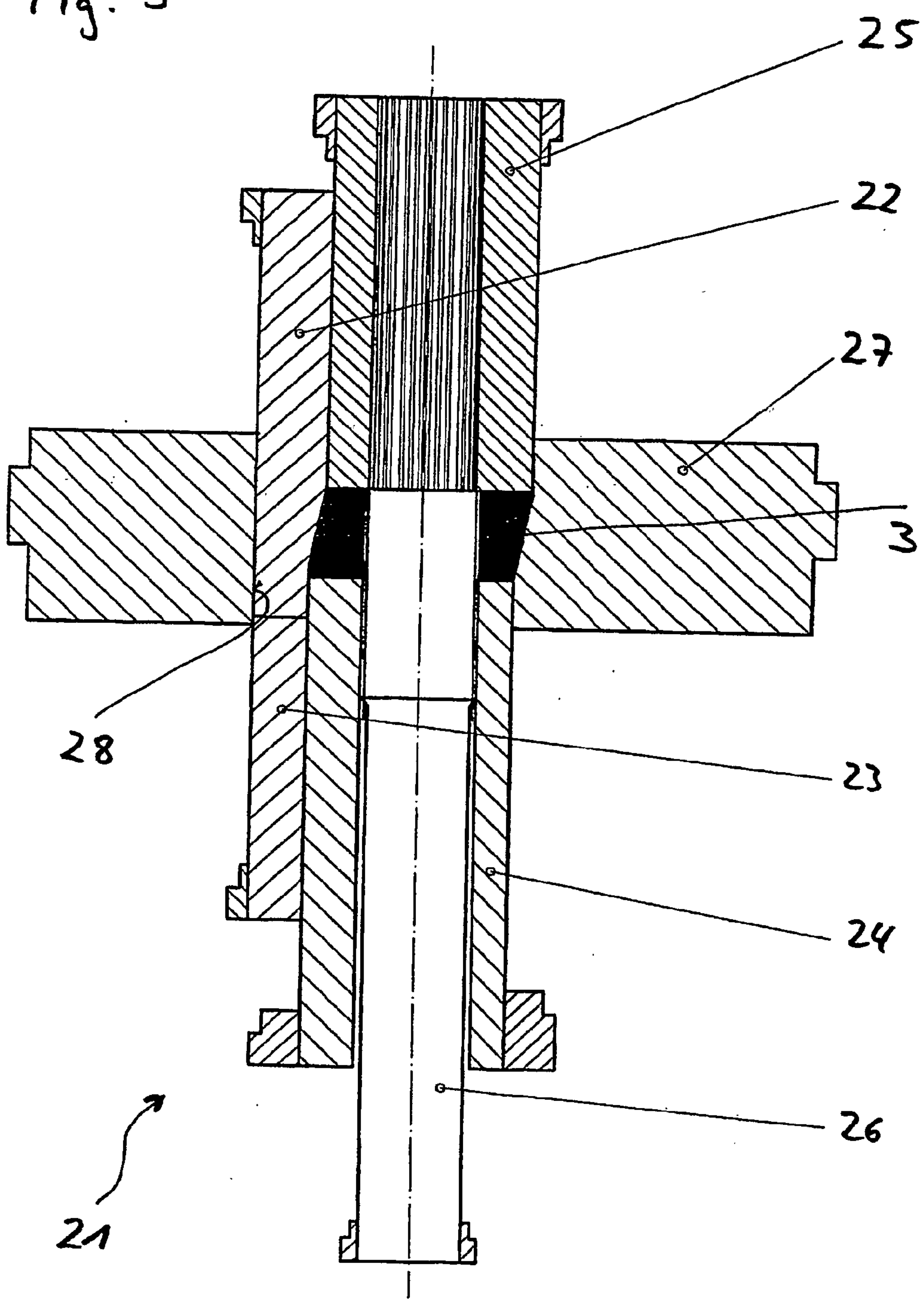
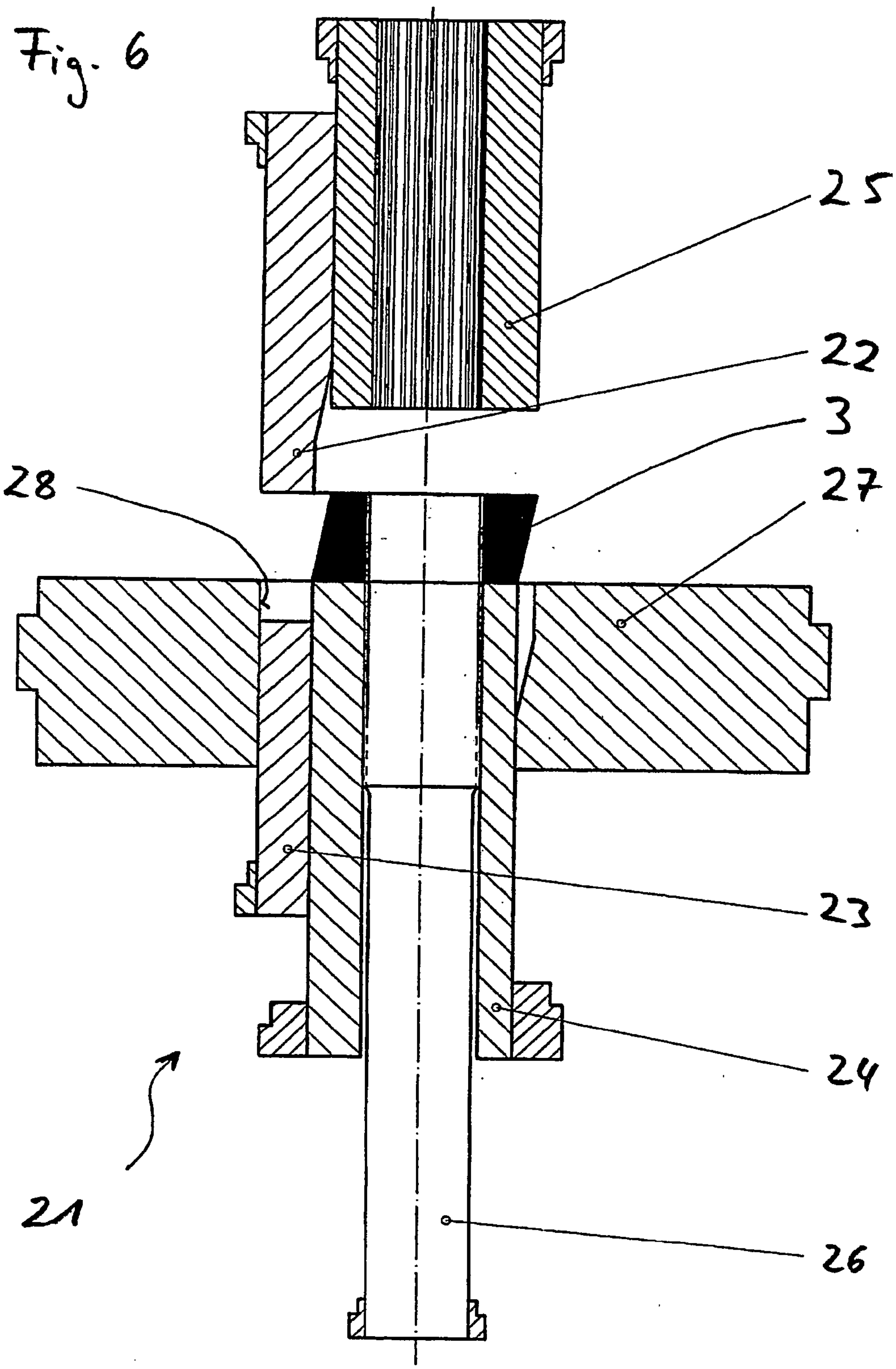


Fig. 6



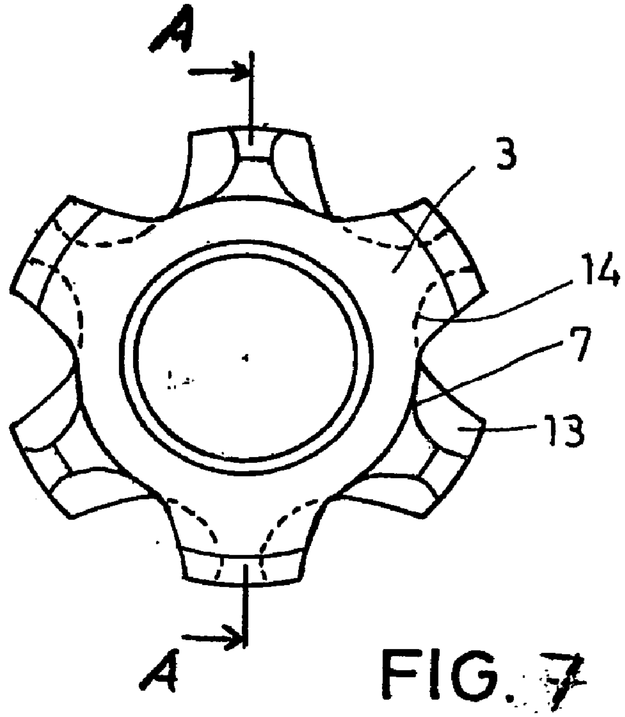


FIG. 7

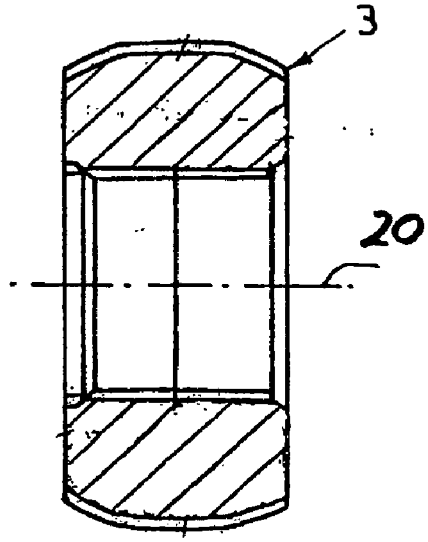


FIG. 8

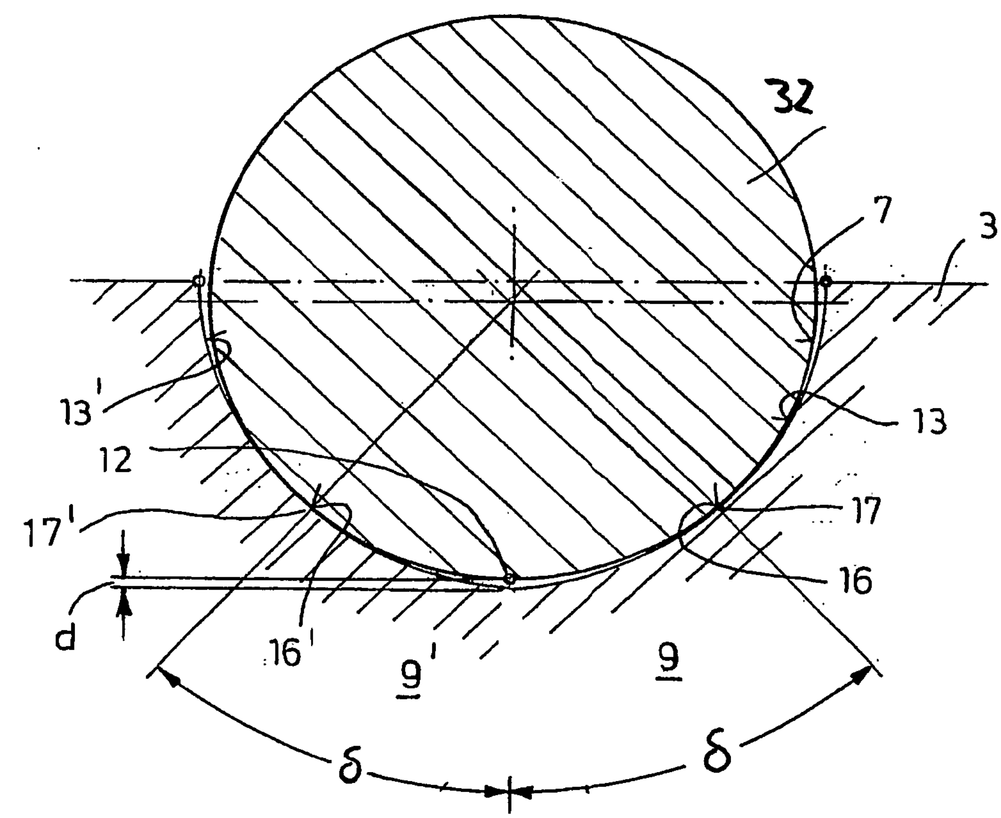


FIG. 9

ONE-PIECE JOINT BODY

[0001] This application claims foreign priority under 35 U.S.C. § 119 of Application No. PCT/EP02/09229 filed Aug. 17, 2002 in PCT, which claims priority to German Application Number 101 42 805.7 filed Aug. 31, 2001.

BACKGROUND OF THE INVENTION

[0002] Cardan joints that consist of an internal and external joint part are well-known. They primarily serve as the torsional moment conversion between shafts that are subjected to much larger shifts while in operation. The inclusion of axial shifts are thereby possible as well.

[0003] An example for the conversion of the torsional moment through shafts that are bent against one another, is the constant velocity cardan joint. The latter belong to the category of Cardan joints, the most common design of which is the universal joint. In the case of the universal joint, the joint forks of both shafts are connected by means of a pin. Essentially, simple universal joints do not allow for small angular changes. Axial and radial displacements of the shafts are not possible.

[0004] The constant velocity cardan joint avoids these disadvantages. Contrary to the universal joints, similarly shaped revolutions are produced on the drive side at uniform angular speed by means of constant velocity cardan joints. The same is valid for the torsional moments.

[0005] The cardan shaft is made of two joints and one intermediate shaft. The intermediate shaft is mostly implemented as telescope shaft in order to compensate for elongations. It is a condition for a monotonous conversion that both joint forks are situated on one level and, in the event that the angles of deflection at both joint forks are the same sizes, at least in the most frequent situation while in operation.

SUMMARY OF THE INVENTION

[0006] It is the objective of this invention to provide a process and a fixture with which a metallic sintered part or forging, in particular an internal joint part of a cardan joint can be manufactured in a simplified and precise manner.

[0007] The invention solves this objective by means of the characteristics named in the process, fixture and factual claims.

[0008] According to the invention, a process was proposed for producing a metallic sintered component or forging, in particular an internal joint part of a Cardan joint, which is provided with a ball path, whereby a charge cavity is filled with powder, the charge cavity is delimited by means of a die, at least one molding mandrel and a charging mandrel positioned opposite the latter, a central mandrel, and at least one lower and upper punch; the powder is compressed in the charge cavity by pressure on the upper and/or lower punch to form a green product, which is then expelled and sintered. Metallic sintered powder is introduced in the charge cavity. The molding mandrel is pulled in until the charging mandrel, and the geometry of parts is fixed through a relative displacement of the tools against one another, and, subsequently, the powder is compressed by pressure in the upper and/or lower punch to form a green product. Upon driving back the upper punch and the molding mandrel, the newly pressed green product is then expelled and sintered from the compression fixture. In order to achieve a higher density it is appropriate when the sintered part is deformed warm or cold after the sintering process. A calibration process after the sintering and/or forging is possible to obtain lower tolerances and/or a partial compression. It is for example advantageous to drum the ball paths of the internal joint part coldly or, alternatively, to drum after the sinter forging.

[0009] Components that have been manufactured according to a sinter-metallurgic process have the advantage that all the bodies of the internal joint part form a high-strength structure that demonstrates excellent material features and surface quality.

[0010] It was the intention of the advantageous design of the invention that for the charging process, the charging mandrel runs into the die in a charging position, the central mandrel runs into the die in a charging position and the lower punch is maintained in a charging position. During the pressing procedure, the molding mandrel that is attributed to the charging mandrel runs into the die, whereby the molding mandrel pushes the charging mandrel downward in the die and the ball paths are thereby shaped in powder through the geometry of the molding mandrel. At the same time, the upper punch runs into the die until at upper punch pressing position, and the powder is compressed to the green product whereby ball paths are created through the geometry of the die. The lower punch runs into the die until at lower punch pressing position and also the powder is compressed. The upper punch and molding mandrel extend from the die and the central mandrel is withdrawn from the green product during the discharge procedure. The external outline of the internal joint part, the inner race, is partially formed by the die itself and partially by molding mandrels moving in the pressing direction in the die. Depending on the geometry of the internal joint part, at least two upper molding mandrels and two lower charging mandrels, preferably three mandrels, which are mounted in the die and are movable in the pressing direction, are provided for.

[0011] In a particular advantageous design of the invention, the plan is that the side of the charging mandrel in the charging position, which is turned towards the molding mandrel, flushes with the top side of the die and the top side of the central mandrel, that the molding mandrel in the charging positions is positioned at the top side of the charging mandrel and pushes these back. At the same time pressure is exercised on the upper punch, which runs into the die, and afterwards the upper punch and molding mandrel extend from the die and the newly pressed green product is expelled from the die through the lower punch.

[0012] Within the appropriate design of the invention, it is the intention to compress the powder to a green product through pressure and heat.

[0013] It is the intention of the particularly appropriate design of the invention that the die and at least a punch is heated up during the pressing.

[0014] Within the appropriate design of the invention, it is planned that the form of the ball paths are shaped by the molding mandrel.

[0015] Within a further appropriate design of the invention, it is intended for the form of the ball paths to be shaped by the molding mandrel and the die.

[0016] In an advantageous design of the invention, it is provided that the surface of the ball paths is compressed after the sintering procedure. The compression of the surface in order to achieve a higher level of firmness can for instance take place through drumming, whereby it is advantageous when solely partitions of the ball path surface is compressed. It is appropriate if at least the contact surface of the balls of the ball path surface is compressed.

[0017] In a particular advantageous design of the invention, it is intended that, following the sintering procedure, the surface of the ball paths is compressed at least by means of a ball, which exercises pressure vertically onto the ball path surface.

[0018] Within a further appropriate design of the invention, it is the plan that at least once the ball compresses at least one partition. It is appropriate if the ball, which is preferably made of carbide, rolls at least once, particularly multiple times over the surface to be compressed, so that the surface is gradually compressed and deformed.

[0019] In an advantageous design of the invention, it is the intention that the readymade sintered part is subsequently forged whereby the sintered part is inserted in the die on a central mandrel by means of ball paths, a forging tool presses the sintered part for shaping purposes and for the external outline, and is afterwards expelled.

[0020] Within a further appropriate design of the invention, it is provided that the readymade sintered part is calibrated following the sintering or forging procedure, whereby the sintered part is inserted in the die on a central mandrel by means of ball paths, a calibration tool presses the sintered part for shaping purposes and for the external outline, and is afterwards expelled.

[0021] An addition solution of the task is stated through a fixture for the manufacture of metallic sintered parts, in particular of an internal joint part of a cardan joint, with ball paths, with a pressing fixture, with at least one molding mandrel and at least one charging mandrel attributed to a molding mandrel, an upper and lower punch and a central mandrel that shape the charge cavity and are radially surrounded by a die. Such a pressing fixture is characterized by a simple sequence of operations. The pressing procedure is cost-effective and primarily time-saving in comparison to the known metal-cutting manufacture. As a result of this, it is possible to manufacture a large quantity of internal joint parts in short period of time. The die that encloses the charging and molding mandrels intercepts the pressure that has a radial effect on the molding mandrels.

[0022] In an advantageous design of the invention, it is the intention that per three molding mandrels and three charging mandrels attributed to these are planned, and which are run in recesses in the die.

[0023] The charging and molding mandrels and the die itself that are positioned in the cavities of the die altogether form the external outline of the internal joint part, that based on its geometrical design cannot be manufactured with the usual pressing fixtures.

[0024] The task is further on solved by means of a metallic sintered part, in particular the internal joint part of a cardan joint, with ball paths positioned on the external perimeter, whereby the sintered part is made of one piece. For reasons of firmness and durability of the internal joint part, it is advantageous to shape the latter in one piece and not to assemble from two for instance pressing-technical easy to manufacture components.

[0025] In an appropriate design of the invention, it is intended that the ball paths are positioned in an angle towards the pressing axle and/or curved towards the pressing axle. The internal joint part is shaped with undercuts, cavities and profiles, preferably with ball paths that are axially aligned and radially curved towards the joint body axle, in other words, also towards the pressing direction. The ball paths are hereby developed with track ground and track sides and the internal joint part demonstrates a geometry which enables it to press the internal joint part axially and to withdraw it from the pressing fixture and forging fixture, respectively.

[0026] In a further appropriate design of the invention, it is intended that the ball paths are round-shaped.

[0027] In an advantageous design of the invention, it is provided that the ball paths are roughly elliptically shaped. This definition is particularly advantageous, since the balls only bear on two points on the ball paths and results in only one contact line on the ball path during the roll motion. This area is presented as aforesaid, compressed advantageously and, if necessary, heat and/or surface-treated.

[0028] In an appropriate design of the invention, it is intended that the ball paths are constructed with multiple cornerss. Also this design of the ball path offers the advantage, as is the case for the roughly elliptical ball path, that the balls only show a minor bearing area on the ball path and, as a result, the rolling friction decreases and in particular the Hertzian stress can be optimized.

[0029] In advantageous design of the invention, it is intended that the ball paths will indicate a higher density in partitions, particularly in the area of the ball contact surface.

[0030] In a further advantageous design of the invention, it is intended that the ball paths are heat-treated in partitions, particularly in the area of the ball contact surface. Such a component features the advantage that the ball paths acquire a high level of firmness. The component can for instance be heat-treated at least in the area of the ball paths by means of inductive and case hardenings.

[0031] In a particularly advantageous design of the invention, it is intended that the ball paths are surface-treated in partitions, especially in the area of the ball contact surface. The surface for example can be treated in cold and warm conditions through shot peening, plasmanitriding, nitrocarburazing, phosphatizing and drumming in order to optimize the characteristics of the ball contact surface purposefully.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] The invention is portrayed in the drawings on the basis of an embodiment of a constant velocity cardan joint. They show:

[0033] **FIG. 1 A** constant velocity cardan joint,

[0034] **FIG. 2 a** perspective view of a compression molding die for an inner race,

[0035] **FIG. 3** the compression molding die cut with run-in Mandrels,

[0036] **FIG. 4** the compression molding die in the charging Position,

[0037] **FIG. 5** the compression molding die in the pressing Position,

[0038] **FIG. 6** the compression molding die in the discharge Position,

[0039] **FIG. 7** an inner race in top view

[0040] **FIG. 8** an inner race according to section A-A in **FIG. 7**

[0041] **FIG. 9** an inner race with ball in cross-section

DESCRIPTION OF PREFERRED EMBODIMENTS

[0042] **FIG. 1** illustrates a constant velocity cardan joint **1**. It also shows external joint part **2** and internal joint part **3**. External joint part **2** is connected to shaft **4**, and internal joint part **3** is connected to shaft **5**. Shaft **4** and **5** form an propulsion-output system. Interior joint part **3** is included in external joint part **2**. Balls **6** in ball paths **7** are thereby positioned in such a way between external joint part **2** and internal joint part **3**, that balls **6** are directed against one another in ball paths **7** when bending shafts **4**, **5**. The balls run thereby inevitably in the mirror plane. The displayed form shows that the bending angle is 0° and the ball is situated on a level vertically on the straight lines that were shaped by the axles of shafts **4** and **5**. The alignment shows a cap ring **8** which retains the balls in the ball paths. In the event that the axle drive shaft is turned, the output shaft is transferred also in case of corresponding bending within the possible limits with equal revolutions and torsional moment. Cardan joint **1** has been sealed up outwards by means of flexible seal **18**.

[0043] Ball paths **7** can be positioned parallel or in an angle towards the pressing axle (inner race axle **20**).

[0044] It is further on possible that ball paths **7** are curved towards the pressing axle (inner race axle **20**). As a result, radially curved ball paths **7** are a possibility whereby ball paths **7** are equipped with track ground **12** and track sides **13**.

[0045] **FIG. 2** shows a perspective view of a pressing fixture **21** for inner race **3** (internal joint part), whereby pressing fixture **21** features three molding mandrels **22**.**1**, **22**.**2**, **22**.**3** and charging mandrels **23**.**1**, **23**.**2**, **23**.**3** attributed to these. Furthermore, a lower punch **24**, upper punch **25**, as well as central mandrel **26** are provided. The punches **24**, **25** and mandrels **22**, **23**, **26** are radially enclosed by die **27**. Die **27**, which encloses charging and molding mandrels **23**, **22** intercepts the pressure that has a radial effect on molding mandrel **22**.

[0046] Molding mandrel **22** and charging mandrel **23** that is attributed to the latter are run in cavities **28**.**1**, **28**.**2** in die **27**. The charging and molding mandrels **23**, **22** and die **27** itself, which are positioned in cavities **28**.**1**, **28**.**2** make out the external outline of internal joint part **3** that based on its geometrical design cannot be manufactured with usual pressing fixtures.

[0047] **FIG. 3** demonstrates a perspective view of pressing fixture **21** whereby molding mandrel **22** has run into die **27**. Molding mandrel **22** runs into die **27** during the pressing procedure, whereby molding mandrel **22** pushes charging mandrel **23** downward in die **27**, and whereby ball paths **7** of inner race **3** are changed into powder by means of the geometry of molding mandrel **22**.

[0048] **FIG. 4** shows compression molding die **21** in charging position. It is intended that charging mandrel **23** runs into die **27** in a charging position for the charging procedure, that central mandrel **26** runs into the die in charging position and that lower punch **24** is maintained in charging position. Charge cavity **28** is filled with sintered powder **29** in charging position, whereby charge cavity **28** is delimited by die **27**, the three molding mandrels **22**.**1**, **22**.**2**, **22**.**3** and charging mandrels **23**.**1**, **23**.**2**, **23**.**3** attributed to these, central mandrel **26**, as well as by lower and upper punch **24**, **25**. While in charging position, the side of charging mandrel **23** that is turned towards molding mandrel **22** remains at equal height as top side **30** of die **27** and top side **31** of central mandrel **26**.

[0049] Charging and molding mandrels **23**, **22** and die **27** itself, which are positioned in cavities **28** of die **27**, form the external outline of internal joint part **3** that on the basis of its geometrical design cannot be manufactured with the usual pressing fixtures.

[0050] **FIG. 5** demonstrates compression molding die **21** in pressing position. Molding mandrels **22** will run in until charging mandrels **23**, whereby molding mandrel **22** pushes charging mandrel **23** downwards in die **27** and, as a result, ball paths **7** of inner race **3** are changed to powder through the geometry of molding mandrel **22**. At the same time, upper punch **25** is run in die **27** until an upper punch pressing position so that the powder can be compressed to a green product, and whereby ball paths **7** are created also by the geometry of die **27**. Lower punch **24** runs in until a lower punch position is attained, whereby also the powder is compressed. Die **27**, which encloses charging and molding mandrels **23**, **22**, intercepts the pressure that has a radial effect on molding mandrel **22**. A displacement of the tools relatively against one another during the pressing procedure fixes the parts' geometry of inner race **3**.

[0051] It is advantageous when the sintered powder is compressed to a green product with the application of heat. For example, die **27** and at least punch **24**, **25** can be heated up during the pressing.

[0052] **FIG. 6** shows compression molding die **21** in discharge position. Upper punch **25** and molding mandrel **22** are extended from die **27** during the discharge procedure. Central mandrel **26** is retracted from green product **3**. Readymade pressed green product is expelled from the die by means of lower punch **24**.

[0053] Subsequently, green product **2** is sintered.

[0054] It is an advantage when the readymade sintered green product **3** is cold and hot deformed after the sintering procedure in order to achieve a higher density. A calibration procedure after the sintering and/or forging is possible to obtain lower tolerances and/or a partial compression. It is for instance an advantage to drum ball paths **7** of internal joint part **3** cold or, alternatively, to drum after the sintering-forging. It is advantageous when only partitions of the ball path surface is compressed whereby at least contact area **16** of balls **32** of the ball path surface must be compressed.

[0055] The compression of the ball path surface can for instance occur as a result of the fact that the surface of ball paths **7** is compressed by means of a ball after sintering, the pressure is exercised vertically onto the ball path area, whereby the ball at least one compresses at least a partition of ball path **7**. It is, however, advantageous if the ball, which preferably consists of hard metal, roll multiple times across the area to be compressed so that the surface can be gradually compressed and deformed.

[0056] It is an advantage if readymade sintered part **3** is subsequently forged, whereby sintered part **3** is inserted in die **27** by means of ball path **7** onto central mandrel **26**, a forging tool for shaping the external outline presses sintered part **3**, and, subsequently, the latter is expelled.

[0057] It is also advantageous after the sintering and forging procedure, when sintered part **3** is calibrated. Tools can be applied for forging and calibrating purposes, which are roughly of the same build as the aforesaid compression molding die **21**.

[0058] It is also particularly possible to forge a regulinic molding blank to an inner race **3** by means of the aforesaid forging tool.

[0059] **FIG. 7** demonstrates inner race **3** in a top view. Inner race **3** is made of one piece and, as a result, the firmness and durability of inner race **3** is high. Ball paths **7** are positioned in an angle towards the pressing axle (inner race axle **20**). Inner race **3** shows in each case ball paths **7** attributed to one another in pairs. Ball paths **7** are axially aligned within the image plane and demonstrate a radial bending **14**. In each of ball paths **7** attributed to one another in pairs, the curving **14** is opposed, in other words, ball paths **7** run towards one another in an axial direction. Inner race axle **20** runs vertically towards the image plane through the center of inner race **3**.

[0060] **FIG. 8** shows inner race **3** according to section A-A in **FIG. 7**.

[0061] **FIG. 9** demonstrates ball path **7** with a ball **32** in section. Ball **32** shows a round geometry. Ball path **7** shows a geometry that is roughly elliptical. Ball **32** runs on contact surface **16, 16'** and has two points of contact **17, 17'** on ball path **7** at all times. Every point of contact **17, 17'** is situated on another track side **13, 13'**. The points of contact **17, 17'** are separated from one another in angle 2δ from the center of the ball. This design is particularly advantageous, since balls **32** are positioned only on two points on ball path **7** and results in only one contact line on ball path **7** during the roll motion. Thus, as balls **32** only have a small bearing area on ball path **7**, it decreases the rolling friction. The curving of ball **32** and of ball path **7** are optimized in such a way that the Hertzian stress is minimized. This area is advantageously compressed and, if necessary, heat and/or surface treated. Possible processes would be for instance inductive hardenings, case hardenings, shot peening, plasmanitriding, nitrocarburizing, phosphatizing and drumming in cold and hot conditions.

What is claimed:

1. A process for the manufacture of a metallic sintered part, in particular an internal joint part **(3)** of a cardan joint **(1)**, which is provided with a ball path **(7)**, whereby a charge cavity **(28)** is filled with powder, the charge cavity **(28)** is delimited by means of a die **(27)**, at least one molding mandrel **(22)** and a charging mandrel **(23)** positioned opposite the latter, a central mandrel **(26)**, and at least one lower and upper punch **(24, 25)**; the powder is compressed in the charge cavity by pressure on the upper and/or lower punch **(24, 25)** to form a green product, which is then expelled and sintered.

2. The process according to claim 1, characterized by the fact, that for the charging process, the charging mandrel **(23)** runs into the die **(27)** in a charging position, and the lower punch is maintained in a charging position. During the pressing procedure, the molding mandrel that is attributed to the charging mandrel **(23)** runs into the die **(27)**, whereby the molding mandrel **(22)** pushes the charging mandrel downward in the die **(27)** and the ball paths are thereby shaped in powder through the geometry of the molding mandrel **(22)**. At the same time, the upper punch runs into the die until at upper punch pressing position, and the powder is compressed to the green product whereby ball paths **(7)** are created through the geometry of the die. The lower punch runs into the die until at lower punch **(24)** pressing position and also the powder is compressed. The upper punch **(25)** and molding mandrel **(22)** extend from the die **(27)** and the central mandrel **(26)** is withdrawn from the green product **(3)** during the discharge procedure.

3. The process according to claim 1, characterized by the fact, that the side of the charging mandrel **(23)** in the charging position, which is turned towards the molding mandrel **(22)**, flushes with the top side **(30)** of the die **(27)** and the top side of the central mandrel **(26)**, that the molding mandrel **(22)** in the charging positions is positioned at the top side **(31)** of the charging mandrel **(23)** and pushes these back. At the same time pressure is exercised on the upper punch **(25)**, which runs into the die **(27)**, and afterwards the upper punch **(25)** and molding mandrel **(22)** extend from the die **(27)** and the newly pressed green product **(3)** is expelled from the die **(27)** through the lower punch **(24)**.

4. The process according to claim 1, characterized by the fact, that the powder is compressed to a green product through pressure and heat.

5. The process according to claim 1, characterized by the fact, that the die and at least on punch **(24, 25)** is heated up during the pressing.

6. The process according to claim 1, characterized by the fact, that the shape of the ball paths **(7)** is created by the molding mandrel **(27)**.

7. The process according to claim 1, characterized by the fact, that the shape of the ball paths **(7)** is formed by the molding mandrel **(22)** and the die **(27)**.

8. The process according to claim 1, characterized by the fact, that the surface of the ball paths **(7)** is compressed after sintering.

9. The process according to claim 1, characterized by the fact, that the surface of the ball paths **(7)** is compressed at least by a one ball **(32)** after sintering, the pressure is exercised vertically onto the ball path surface, whereby the compression can occur in cold and hot conditions.

10. The process according to claim 9, characterized by the fact that the ball **(32)** at least once compresses at least a partition of the ball path **(7)**

11. The process according to claim 1, characterized by the fact, that the readymade sintered component **(3)** is subsequently forged, whereby the sintered component **(3)** is inserted in the die **(27)** on a central mandrel **(26)** by means of ball paths **(7)**, a forging tool of the same build for shaping the external outline of the sintered component **(3)** presses, and is afterwards expelled.

12. The process according to claim 1, characterized by the fact, that the readymade sintered component **(3)** is calibrated after sintering or forging, whereby this component is inserted in the die **(27)** on a central mandrel **(26)** by means of ball paths **(7)**, a calibration tool of the same build for shaping the external outline of the sintered component **(3)** presses, and is subsequently expelled.

13. A process for the manufacture of a metallic component, in particular an internal joint part **(3)** of a cardan joint **(1)**, which is provided with a ball path **(7)**. A molding blank is thereby inserted in the die **(27)** on a central mandrel **(26)**, a forging tool of the same build for shaping the external outline of the molding blank presses, and is afterwards expelled.

14. A fixture for the manufacture of metallic components, in particular components made according to a sinter-metallurgic and/or forging process, particularly an internal joint part of a cardan joint **(1)**, with ball paths **(7)**, according to the process in correspondence with claim 1, characterized by a pressing fixture **(21)** with at least one molding mandrel **(22)** and at least one charging mandrel **(23)** attributed to the molding mandrel **(22)**, one lower and one upper punch **(24, 25)** and one central mandrel **(26)**, which shape the charge cavity **(28)** and are radially enclosed by a die **(27)**.

15. The fixture according to claim 14, characterized by the fact, that three molding mandrels **(22)** and three charging mandrels **(23)** attributed to the latter are provided, which are run in cavities **(28)** in the die **(27)**.

16. The metallic component, in particular a component manufactured according to a sinter-metallurgic and/or forging procedure, particularly an internal joint part **(3)** of a cardan joint **(1)**, with ball paths **(7)** positioned on the external perimeter, manufactured according to the process in correspondence with the process claim 24, characterized by the fact, that the sintered component is made of one piece.

17. The metallic component, in particular a component manufactured according to a sinter-metallurgic and/or forging procedure, particularly an internal joint part **(3)** of a cardan joint **(1)**, according to claim **24**characterized by the fact, that the ball paths **(7)** are positioned in an angle towards the pressing axle **(20)** and/or are curved towards the pressing axle **(20)**.

18. The metallic component, in particular a component manufactured according to a sinter-metallurgic and/or forging procedure, particularly an internal joint part **(3)** of a cardan joint **(1)**, according to one of claim 24 characterized by the fact, that the ball paths **(7)** are round-shaped.

19. The metallic component, in particular a component manufactured according to a sinter-metallurgic and/or forging procedure, particularly an internal joint part **(3)** of a cardan joint **(1)**, according to claim 24 characterized by the fact, that the ball paths **(7)** are roughly elliptically shaped.

20. The metallic component, in particular a component manufactured according to a sinter-metallurgic and/or forging procedure, particularly an internal joint part **(3)** of a cardan joint **(1)**, according to claim 24 characterized by the fact, that the ball paths **(7)** are shaped with multiple corners.

21. The metallic component, in particular a component manufactured according to a sinter-metallurgic and/or forging procedure, particularly an internal joint part **(3)** of a cardan joint **(1)**, according to claim 24 characterized by the fact, that the ball paths **(7)** show a higher density in partitions, particularly in the area of a ball path contact area **(16, 16')**.

22. The metallic component, in particular a component manufactured according to a sinter-metallurgic and/or forging procedure, particularly an internal joint part **(3)** of a cardan joint **(1)**, according to claim 24 characterized by the fact, that the ball paths **(7)** are heat-treated in partitions, particularly in the area of a ball path contact area **(16, 16')**.

23. The metallic component, in particular a component manufactured according to a sinter-metallurgic and/or forging procedure, particularly an internal joint part **(3)** of a cardan joint **(1)**, according to claim 24 characterized by the fact, that the ball paths **(7)** are surface-treated in partitions, particularly in the area of a ball path contact area **(16, 16')**.

24. A metallic component, in particular a component manufactured according to a sinter-metallurgic and/or forging procedure, particularly an internal joint part **(3)** of a cardan joint **(1)**, according to claim 1.

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