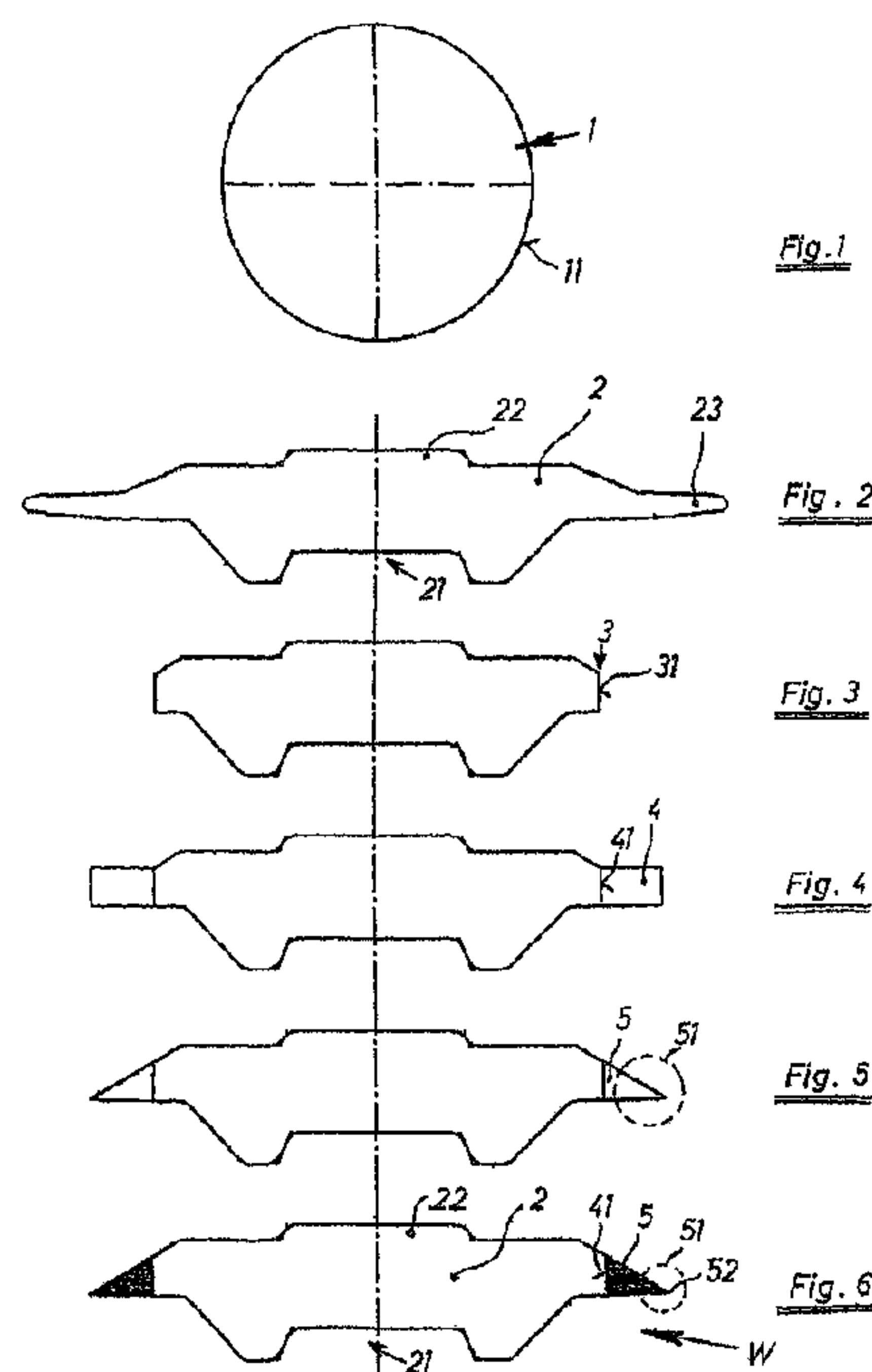




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(54) Titre : PROCÉDE DE FABRICATION DE LAMES REVERSIBLES
(54) Title: METHOD FOR PRODUCING REVERSIBLE BLADES



(57) **Abrégé/Abstract:**

The invention relates to a method for producing reversible blades (W) having a profiled cross-section, in particular for use in chippers for splitting wood, comprising in the cross-section a proximal carrier part (2) having at least one fitting means (21, 22) for fastening the blade (W) in a detachable and sliding-proof manner and on both sides of the carrier part (2) a distal chipping area (5) that contains the cutting edges (52), wherein a starting material (1) having a large longitudinal extension is subjected to surface processing (11) and a carrier profile (2) is formed therefrom by rolling. In order to economically optimize the property profile of reversible cutting blades, according to the invention the distal areas (23) of the carrier part (2), which is deformed in an overfilled roll groove and which has a large longitudinal extension, are removed asymmetrically in the longitudinal direction during throughput in order to form a connecting surface (31) in each case, whereupon one attachment part (4) made of tool steel is fastened to each of said processed surfaces (31) of the carrier part (2) by means of a metallic bond (41), and chipping areas (5) each having a cutting area (51) and a cutting edge (52) are formed from the attachment parts (4) by machining, on which edge areas (5) a heat treatment and then cutting to length to form usable reversible blades (W) occur.

Abstract

The invention relates to a method for producing reversible knives (W) with profiled cross section, in particular for a use in chopping machines for wood chipping, composed in cross section of a proximal support part (2) with at least one fitting means (21, 22) for fastening the
5 knife (W) in a detachable and displacement-proof manner and on both sides on the support part (2) a distal chipping region (5) containing the cutting edges (52) , wherein a preliminary material (1) with large longitudinal extension is subjected to a surface processing (11) and a support profile (2) is formed therefrom by rolling. In order to economically optimize the property profile of reversible knives it is provided according to the invention that the distal
10 regions (23) of the support part (2), worked in an overfilled rolling groove and having a large longitudinal extension, are removed in passage, respectively forming a bonding surface (31) axially symmetrically in the longitudinal direction, after which respectively one attachment part (4) of tool steel is attached to these processed surfaces (31) of the support part (2) by means of metallic bonding (41), and from the attachment parts (4) chipping regions (5) with
15 respectively one blade region (51) and one cutting edge (52) are shaped by chip removal, on which edge regions (5) a thermal material treatment and subsequently a cutting to length take place to produce reversible knives (W) ready for operation.

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Method for producing reversible knives

The invention relates to a method for producing reversible knives with profiled cross section, in particular for a use in chopping machines for wood chipping, composed in cross section of a proximal support part with at least one fitting means for fastening the knife in a detachable
5 and displacement-proof manner and on both sides on the support part a distal chipping region containing the cutting edges, wherein a preliminary material with large longitudinal extension is subjected to a surface processing and a support profile is formed therefrom by rolling.

The prior art includes reversible knives of the type described above in different embodiments. The embodiments mainly represent advantageous economical and/or technical innovations
10 with respect to a special property profile of the knives.

EP 0 271 481 A, for example, discloses a method for producing in particular machine blades of hot-rolled flat steel, wherein a roll tab with homogeneous material structure in the cutting edge region is formed essentially on the side surface by overfilling the last groove.

From DE-OS-27 04 999 a method is known for producing strip-steel knives in continuous
15 passage, wherein the strip is provided with a central groove or flute and the strip is guided on this groove or flute through the following work zones.

A reversible knife that can be used in a knife carrier in a predetermined position by projections or recesses interacting in terms of fit, and two welded-on working parts distal in cross section with blades of high-alloy tool steel, is disclosed by document AT 398 401 B.

20 Flat-steel knives with a rear end part optionally pressed on or a curved end part for attachment, which is positioned opposite the blade part, formed of tool steel, with a cutting edge are known from US 2009/021 7794 A1.

Reversible knives of the referenced type have economical disadvantages due to a complex production method and/or disadvantages of inadequate product quality or a lack of individual
25 desired use qualities.

The object of the invention is now to disclose a generic method for producing reversible knives, by means of which the property profile thereof is optimized economically even with harsh stresses in use.

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- This object is attained with a method of the type mentioned at the outset in that the distal regions of the support part, worked in an overfilled rolling groove and having a large longitudinal extension, are removed in passage, respectively forming a bonding surface axially symmetrically in the longitudinal direction, after which respectively one attachment
- 5 part of tool steel is attached to these processed surfaces of the support part by means of metallic bonding, and from the attachment parts chipping regions with respectively one blade region and one cutting edge are shaped by chip removal, on which edge regions a thermal material treatment and subsequently a cutting to length take place for reversible knives ready for operation.
- 10 The advantages achieved with the method according to the invention are essentially due to the fact that proximal fitting means and distal regions of the support part are simultaneously formed from the preliminary material by rolling in an overfilled groove, which distal parts far towards the longitudinal axis have a cold-worked, essentially unoriented structure and consequently a preferred strengthening of the material. These distal hardened parts, partially
- 15 pressed out of the groove, are removed essentially at room temperature and a flat surface is formed, wherein it is ensured that the strength of the material achieved by cold working is retained in the flat region.

Attachment parts of tool steel are metallicity connected to the surfaces of the support part formed in this manner, wherein the connection or welding is carried out in a high-energy

20 manner, that is, without disadvantageous depth action. In this manner only an unimportant reduction in strength of the material of the support part hardened by cold working is achieved in the connection region, which produces a desired high mechanical stability of a fixing of the attachment part.

A forming of a chipping region with a cutting edge takes place respectively on the attachment

25 part by means of cutting, optionally in combination with partial cold working, wherein a high-strength connection to the support part is maintained.

A thermal material hardening and tempering of the edge region is thereby provided such that no heat affecting of the zone with the metallic bond or welding without any additional materials takes place on the attachment part.

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A final sharpening of the blade and a cutting to length of the knives can now take place in a simple manner.

In one embodiment of the invention it is advantageous if the preliminary material with large longitudinal extension, after a dimensionally exact processing of the surface thereof and
5 before a rolling to form a support part, is heated by a rapid heating in a period of less than 50 sec., in particular of less than 15 sec., preferably by means of induction heating, in passage to a temperature of less than 900°C with the proviso that the structure of the material remains in a cubic body-centered atomic structure. In this manner, by means of a directly upstream dimensionally exact processing of the surface, an exact dimensioning of the preliminary
10 material and thus a precise definition of the dimensions of the rolled product, on the one hand, and, on the other hand, a high quality non-scaling surface quality of the support profile, in particular the adjacent surfaces of the fitting means, take place. To avoid a disadvantageous oxide formation, it is advantageous for the preliminary material to provide a rapid heating in a period of less than 50 sec., which heating is preferably carried out by
15 induction in passage. A maximum temperature for shaping the preliminary material is determined by the chemical composition or by the carbon content of the material. For a work hardening of the material during the shaping, at most a temperature is necessary at which a recrystallization of the structure is avoided and thus a forming of the part takes place in the temperature range with cubic body-centered atomic structure.

20 In order to achieve favorable conditions for a connection of the attached parts by fusion welding without any additional material with a small heat-affected zone, it can be advantageous with respect to a good adhesion and a precise consistence over the longitudinal extension if axially symmetrically distal regions are removed from the shaped support part during its guidance by the fitting means in passage with the formation of processed flat
25 surfaces, wherein the width of the surfaces is more than 0.9 mm but less than 2.9 mm.

It is thereby advantageous in terms of bonding technology if with a shift in the longitudinal axial direction and with guidance of the support part by the fitting means, this is metallurgically fixed with attached parts of tool steel with a thickness of more than 0.9 mm but less than 2.9 mm and a width of 1.0 mm to 4 mm by fusion without any additional material, in particular
30 by means of laser welding.

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Advantageously, the carbon content of the usually low-alloy support part is to be oriented to the carbon activity of the attached parts established by alloying technology, in order to keep low or inactive a carbon diffusion to the high-alloy tool steel and thus a danger of a formation of a brittle region in the welding zone.

- 5 If the attached parts on the support part are further developed by cutting and/or by non-cutting shaping to form chipping regions essentially triangular in cross section with cutting edges, the mechanical stresses in the region of the connection zone can be minimized in a favorable manner and the material strength therein can be increased.

- 10 Advantageously, the blade regions with the cutting edges on the chipping part after a final machining to the axially symmetrical precise representation of the cutting edges in passage are subjected to a thermal material quenching and tempering by hardening and quenching the blade region of tool steel. In this manner desired properties and hardness values of the blade regions with respect to the field of use of the knives can be adjusted. However, it is necessary thereby to restrict the material quenching and tempering of the tool steel to the blade region
15 and to avoid a disadvantageous heating of the chipping part in the region of the weld seam because an embrittling therein can lead to a breakage of the metallic bond.

- It can be favorable for economic reasons if optionally from an intermediate storage a support part with great longitudinal extension after shaping of the distal chipping and blade regions and a thermal quenching and tempering of the regions with the dressed cutting edges is cut to
20 length and finally formed to produce reversible knives ready for use.

The invention is described in more detail below based on drawings which are intended to illustrate a production process for knives, and on exemplary embodiments, which show only one way of carrying out the invention.

The graphical representations show

- 25 Fig. 1 Preliminary material

Fig. 2 Shaped support part

Fig. 3 Processed support part

Fig. 4 Support part with attached part

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Fig. 5 Support part with chipping region

Fig. 6 Reversible knife

Fig. 1 shows a cylindrical preliminary material 1 with a processed surface 11 with a rough depth R_y , (R_z ISO) of less than 45 μm .

- 5 Fig. 2 shows a support profile 2 shaped by means of rolling with an overfilled groove, which support profile in the distal regions respectively has a roll tab 23. During rolling fitting means 21, 22 with a concave shape 21 and a convex 22 shape have been worked proximally at the same time into the carrier body 2.

- 10 Fig. 3 shows diagrammatically a support profile body produced by separation 3 from the distal roll tabs 23 and provided with processed surfaces 3.

Fig. 4 shows in a schematic illustration respectively one attached part 4 fixed to the support part 2, wherein a metallic bonding 41 of the parts 2, 4 was carried out by fusing without any additional material, in particular by means of laser welding.

- 15 Fig. 5 shows respectively a chipping part 5 formed by processing an attached part 4, with a blade region 51 distanced from a bond or a weld seam 41.

- Fig. 6 shows diagrammatically a knife W cut to measured length comprising a support part 2 with proximally positioned fitting means 21, 22 comprising a concave indentation 21 shaped in the knife axial longitudinal direction and a convex projection 22 lying opposite with attached parts 4 permanently attached to the support part 2 distally by metallic bonding 41, 20 which attached parts are further developed to form chipping parts 5 and have thermally hardened blade regions 51 with cutting edges 52.

- By means of practical tests so-called "trimetal" reversible knives of a support part 2 formed of high carbon steel and a chipping part 5 comprising a high-speed steel alloy EN/DIN material no. 1.3247 or AISI-M42 hardened and tempered to a hardness of 65 HRC in the 25 blade region were examined and tested practically in a hard insert.

Test results showed that, above a certain carbon content of the support part 2 material, a carbon diffusion towards the tool steel part in the connection region 41 can take place

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depending on temperature and time, whereby brittle regions formed in the weld seam can cause the chipping parts 5 to break loose.

Support parts 2 of carbon steels with a low C concentration of less than 0.35% by weight showed this danger to a much lower extent, wherein a prior strengthening of the material
5 caused by cold working at a temperature in the alpha range of the alloy provides sufficient toughness and strength properties for extreme stresses of the knives even after an attachment by welding of an attached part 4.

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Claims

1. A method for producing reversible knives (W) with profiled cross section, in particular for a use in chopping machines for wood chipping, composed in cross section of a proximal support part (2) with at least one fitting means (21, 22) for fastening the knife (W) in a detachable and displacement-proof manner and on both sides on the support part (2) a distal chipping region (5) containing the cutting edges (52), wherein a preliminary material (1) with large longitudinal extension is subjected to a surface processing (11) and a support profile (2) is formed therefrom by rolling, characterized in that the distal regions (23) of the support part (2), worked in an overfilled rolling groove and having a large longitudinal extension, are removed in passage, respectively forming a bonding surface (31) axially symmetrically in the longitudinal direction, after which respectively one attachment part (4) of tool steel is attached to these processed surfaces (31) of the support part (2) by means of metallic bonding (41), and from the attachment parts (4) chipping regions (5) with respectively one blade region (51) and one cutting edge (52) are shaped by chip removal and/or cold forming, on which edge regions (5) a thermal material treatment and subsequently a cutting to length take place for reversible knives (W) ready for operation.
2. The method according to claim 1, characterized in that the preliminary material (1) with large longitudinal extension, after a dimensionally exact processing of the surface thereof and before a rolling to form a support part (2), is heated by a rapid heating in a period of less than 50 sec., in particular of less than 15 sec., preferably by means of induction heating, in passage to a temperature of less than 900°C with the proviso that the structure of the material remains in a cubic body-centered atomic structure.
3. The method according to one of claims 1 or 2, characterized in that axially symmetrically distal regions are removed from the shaped support part (2) during its guidance by the fitting means (21, 22) in passage with the formation of processed flat surfaces (31), wherein the width of the surfaces is more than 0.9 mm but less than 2.9 mm.

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4. The method according to one of claims 1 through 3, characterized in that with a shift in the longitudinal axial direction and with guidance of the support part (2) by the fitting means (21, 22), this is metalically fixed with attached parts (4) with a thickness of more than 0.9 mm but less than 2.9 mm and a width of 1.0 mm to 4 mm, preferably by fusion without any additional material, in particular by means of laser welding.
5. The method according to one of claims 1 through 4, characterized in that the attached parts (4) are further developed by cutting and/or by non-cutting shaping to form chipping regions (5) essentially triangular in cross section with cutting edges (52).
6. The method according to one of claims 1 through 5, characterized in that the blade regions (51) with the cutting edges (52) on the chipping region (5) of the support part (2) after a final machining to the axially symmetrical representation of the cutting edges (52) in passage are subjected to a material heat treating by quenching and tempering the blade region (51) of tool steel.
7. The method according to one of claims 1 through 6, characterized in that a support part (2) with great longitudinal extension after shaping of the distal chipping and blade regions (5, 51) and a thermal quenching and tempering of the dressed cutting edges (52) is cut to length and finally formed to produce reversible knives ready for use.

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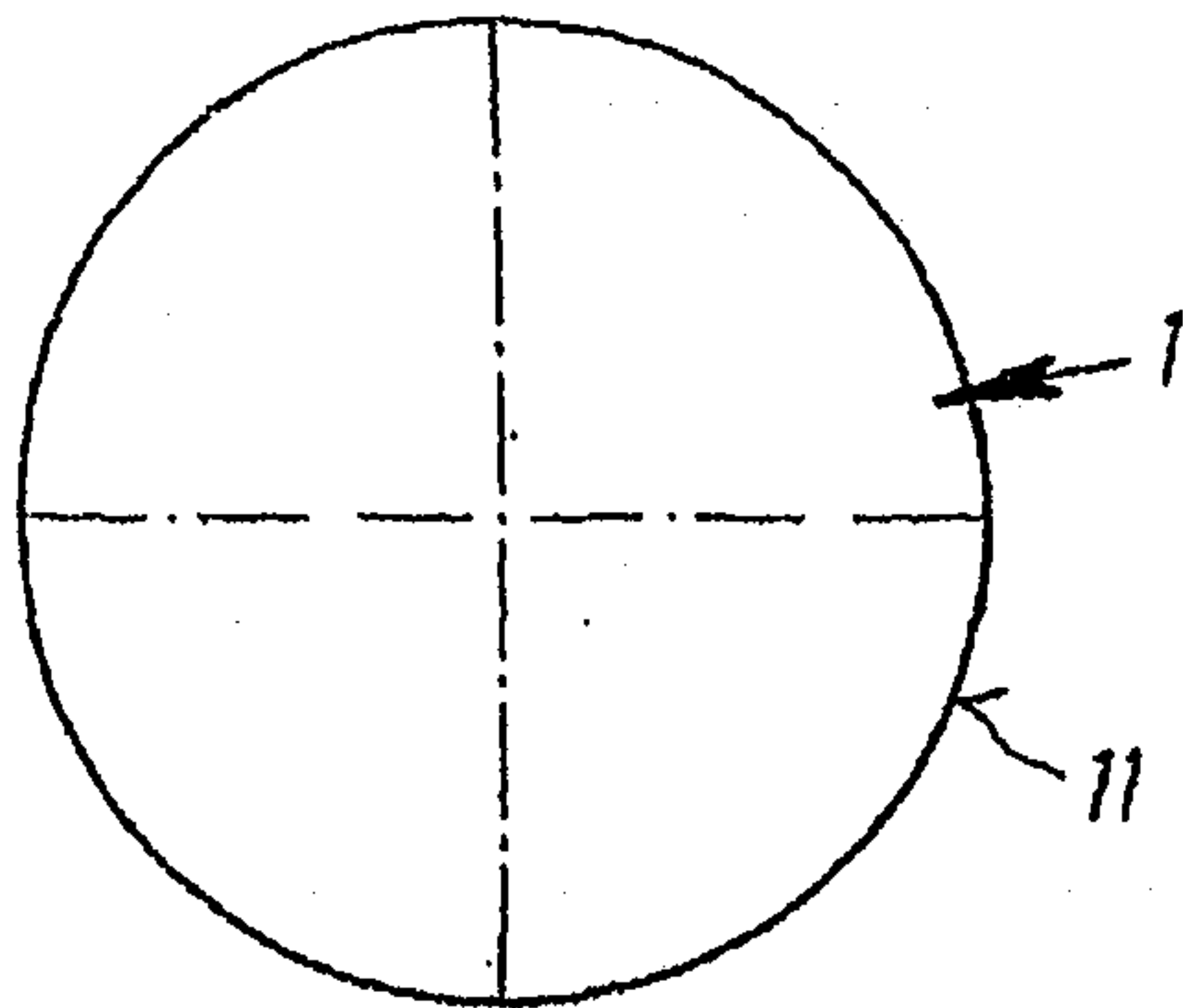


Fig. 1

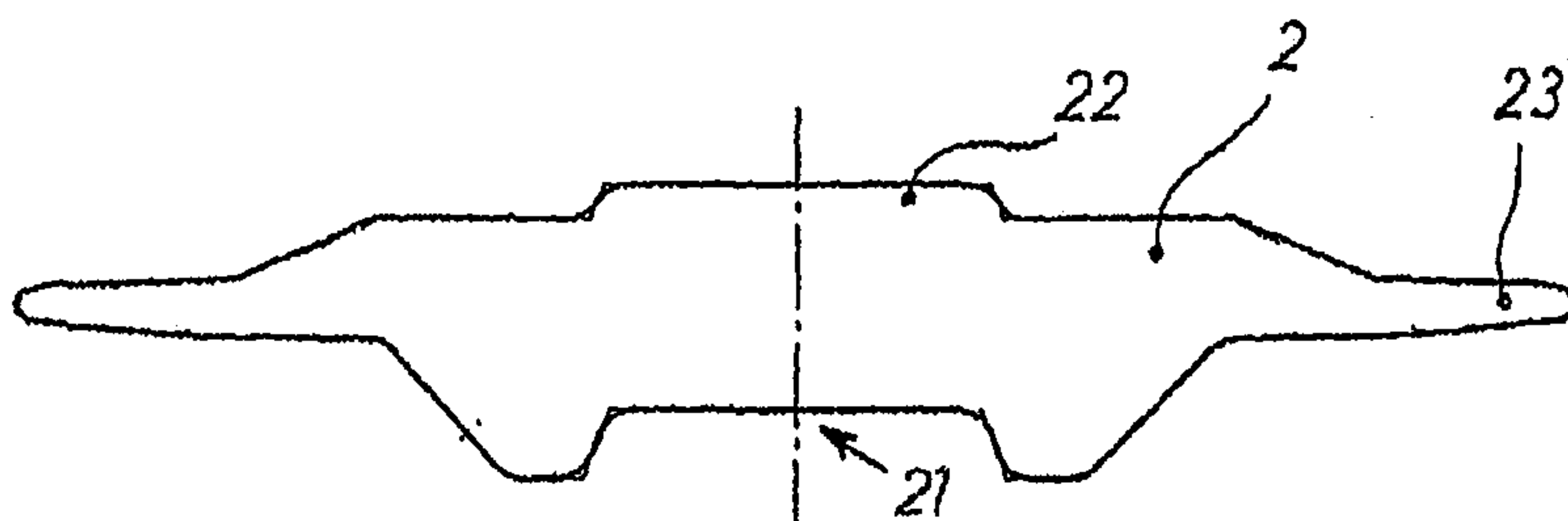


Fig. 2

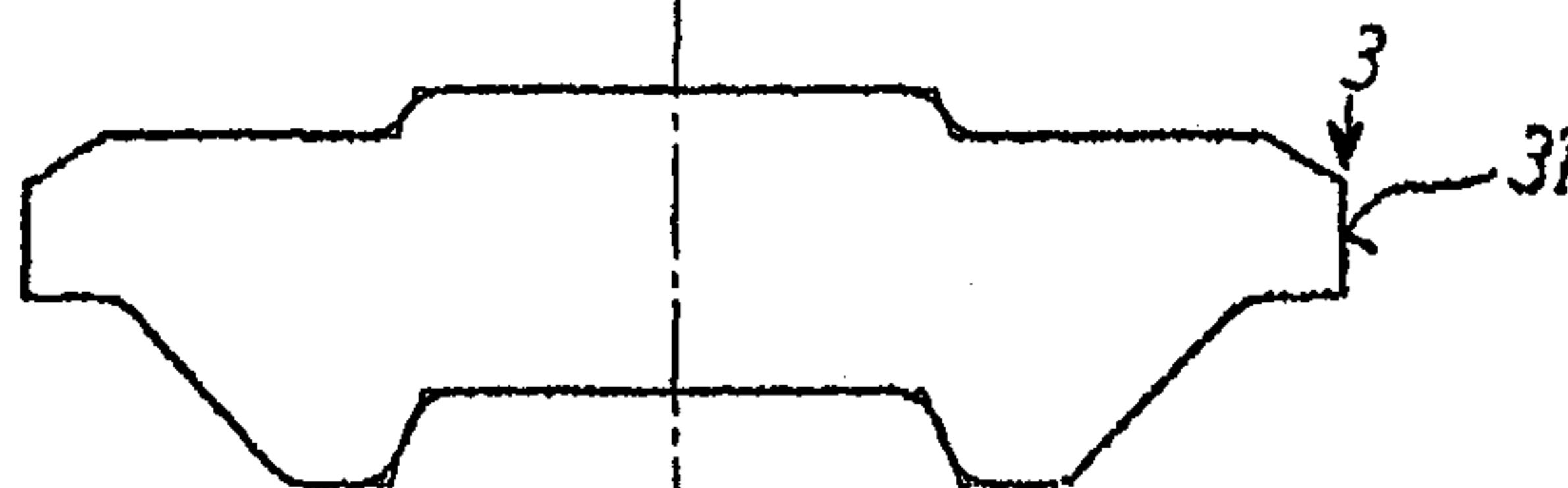


Fig. 3

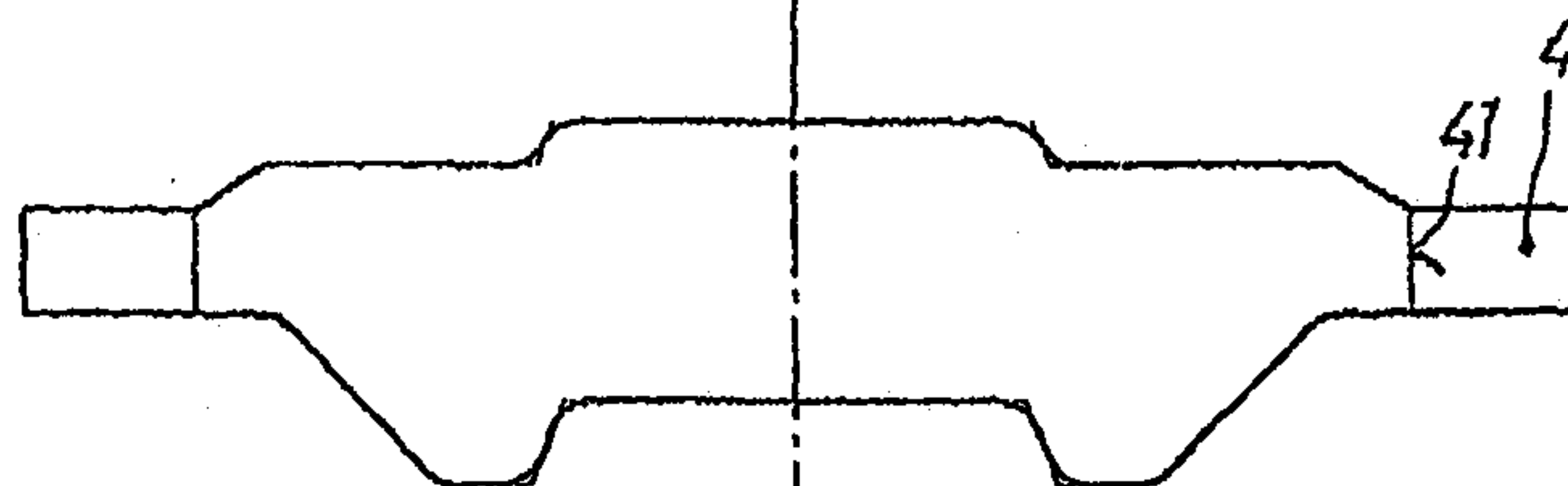


Fig. 4

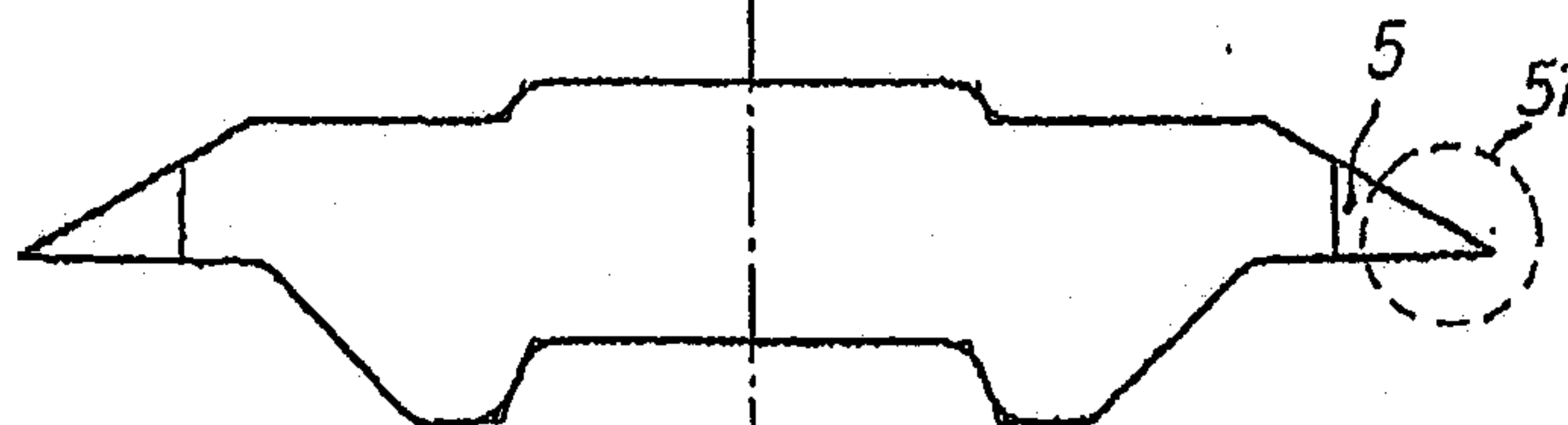


Fig. 5

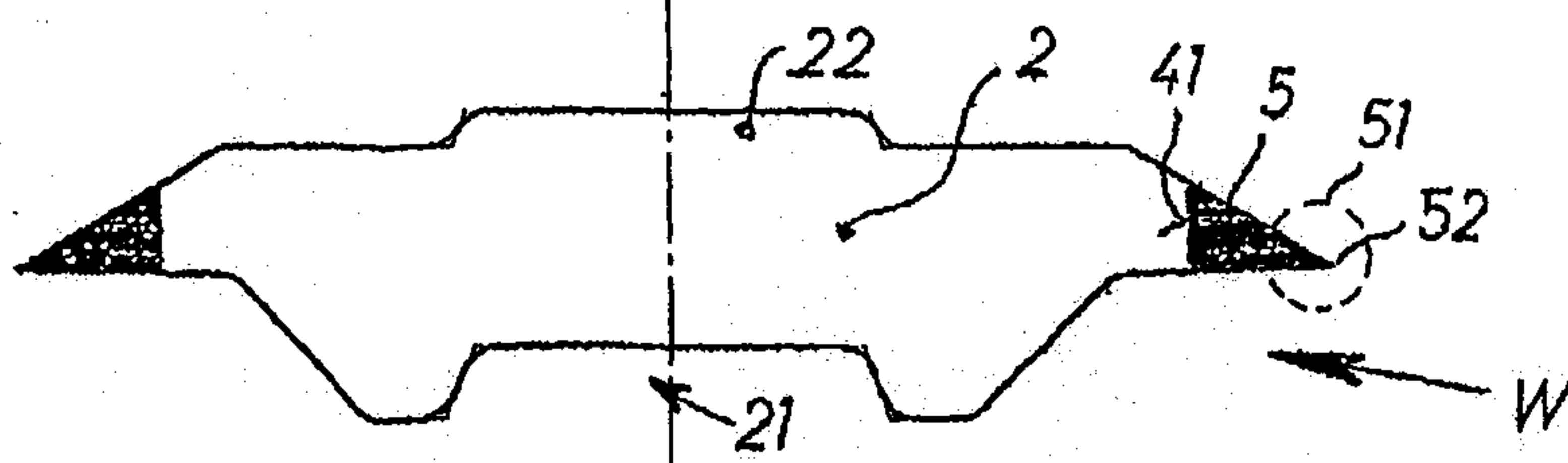


Fig. 6

