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WORKING TOOL, ESPECIALLY SOIL WORKING TOOL

The invention relates to a working tool, in particular a soil-working tool, preferably an agricultural soil-working tool, with a carrier which comprises at least two working elements in the region of a working side, wherein the working elements consist of a hard material, in particular hard metal, or comprising a hard material, wherein the working elements comprise a working section, and wherein the working elements are arranged in a row on the carrier, preferably fixed in a materially-bonded fashion.

In the sense of the invention, working tools are, in particular, agricultural soil cutting tools, for example shares, in particular plowshares, beet harvesters or other shares, cultivators, cultivator tips, share wings, rotary harrow tines or the like.

From DE 10 2009 029 894 A1, agricultural soil-working tools, which comprise a working edge in the region of a carrier, are known. The carrier is equipped with a row of cutting elements at the working edge. These cutting elements can form working elements within the sense of the invention. The cutting elements comprise a leg-like fastening piece. A projection is integrally formed on the leg-like fastening piece at the rear and opposite to the direction of tool advancement. The cutting elements consist of a hard material, namely hard metal, and are soldered to the carrier. The cutting elements are arranged in a row without any gaps.

Known hard materials within the sense of the invention are, for example, hard metals, synthetic diamonds, cubic crystalline boron nitride, titanium nitride, silicon nitride, silicon carbide, boron carbide; tungsten carbide; vanadium carbide; titanium carbide; tantalum carbide; ceramic material, especially aluminum oxide; zirconium dioxide.

The inventors have recognized that in the case of components that are exposed to strongly oscillating loads, there is a risk that the cutting elements arranged in a row will be damaged in the adjoining region due to the component deformation of the carrier. These damages can arise when the cutting elements that are arranged in a row are mounted on the pressure side of the carrier. When the carrier is bent, the cutting elements on the pressure side are compressed on the adjoining faces at a distance from the neutral axis of the carrier about which the carrier is bent. This initiates micro-cracks in the cutting elements. These micro-cracks propagate in the component and lead to crumbling. This crumbling weakens the cutting element, which can lead to a complete loss of the damaged cutting element.

The object of the invention is to create a working tool of the type mentioned at the outset, the tool being characterized by an improved service life of the working elements while being simple to manufacture.

This object is achieved in that the adjoining faces of at least some of the adjacent working elements are arranged opposite one another at a distance in the adjoining region, at least in some areas, thereby forming a gap region, and that at least one of the working elements comprises a spacer which keeps the working elements spaced apart, thereby forming the gap region.

The working elements can be positioned arranged in a row on the carrier for the production process. The working elements in the gap region are reliably kept spaced apart using the spacers. Then, the materially-bonded connecting of the working elements to the carrier takes place. The materially-bonded connection can be put into effect by, for example, a solder connection or an adhesive connection. If, for example, a solder connection is used, namely a hard solder connection, a hard solder can, for example, be positioned between the working elements and the carrier. This pre-mounted composite is placed in a furnace and brought to the melting temperature of the solder material. The spacers ensure that, depending on the component deformation to be expected, at least a predetermined spacing range in the gap region between the adjoining faces of the working elements is maintained and is not undercut. After the working tool has been removed from the furnace and cooled, it is available for use. During operational use, deformations of the carrier caused by vibrations are compensated in the gap region. In particular, the gap region prevents the working elements from being crushed on the adjoining faces when the carrier is deformed. This prevents the risk of cracks forming on the adjoining faces. This leads to an improved service life for the working elements.

It is advantageous if the spacers lie against the opposite working element. In the sense of the invention, however, the spacers do not have to rest on the opposite working element; rather, a distance can be formed between the spacer and the adjacent working element. It is important that a certain minimum distance between the adjoining faces of the working elements opposite one another in the gap region is not undercut.

The object of the invention is also achieved in that the adjoining faces of at least some of the adjacent working elements are arranged opposite one another at a distance in the adjoining region, at least in some areas, thereby forming a gap region, and that at least one of the adjacent working elements comprises a shaped section in the region of the adjoining face, by means of said shaped section the distance in the gap region is continuously and/or discontinuously widened.

In this solution according to the invention, the gap region again prevents the working elements that are arranged in a row from being crushed in the gap region in the event of a bending load. In the process, the inventors build on the knowledge that the compression of the carrier increases continuously with increasing distance from the neutral axis when the component is bent. Accordingly, the gap width close to the neutral axis about which the component is bent can be minimized. The gap width increases with increasing distance from the neutral axis. With the solution according to the invention, an optimized design of the gap region is possible, wherein damage to the working elements in the event of high bending stresses is prevented during working use. In addition, the optimized design of the gap region also optimizes wear. In particular, it is advantageous if the width of the gap region is selected to be as small as possible in order to prevent abrasive wear and tear caused by the processed material, for example soil material.

According to a preferred embodiment variant of the invention, the two solutions according to independent claims 1 and 2 are combined. Accordingly, a working tool is designed in which at least one spacer is provided in the region of the adjoining faces. In addition, at least one of the adjacent working elements in the region of the adjoining face comprises a shaped section by means of which the distance in the gap region is continuously and/or discontinuously widened.

During the production process, in which the bonding material has not yet found its position/or form, the spacers reliably set the desired minimum distance between the working elements. The gap width of the fully mounted working tool is optimally set via the varying distance in the gap region.

It is particularly preferably provided that the at least one spacer is arranged in the gap region, at least in some areas. In this position, the spacer does not affect the rest of the geometry of the working element. After the working tool is produced, the spacer can accordingly remain on the tool and does not have to be cut off in a separate step. In addition, the working element can be easily manufactured as a result of this measure. By cleverly arranging the spacer, preferably in the region of the neutral axis about which the bending of the component takes place, it has little or no effect on the functionality of the tool.

According to a conceivable variant of the invention, it can be provided that the gap region is at least partially filled by means of a bonding material, for example by means of a solder material or an adhesive material, and that the spacer is embedded in the bonding material, at least in some areas.

According to a further variant of the invention, it can be provided that the one or both adjacent working elements comprise at least one integrally-formed spacer. If only one spacer is provided on the working element, then, for example, simply constructed, preferably structurally identical spacers can be arranged in a row to form a row of working elements. When using two spacers, they can be provided at a distance from one another, for example on an adjoining face of the working element, in order to be able to reliably set the defined gap region in this way. It is also conceivable that one or more spacers are provided on opposite adjoining faces of the working element. Furthermore, it is conceivable that the spacers of adjacent working elements lie against one another in the gap region. For example, the spacers can lie against one another in the region of the neutral axis. In the case of spacers lying next to one another, a region of movement is formed in a contact point or a contact line or a contact surface of the spacers at which the spacers can move against one another. In this way, for example, similar to a bearing, a rolling geometry can be put into effect on which the adjacent working elements can roll against one another when the carrier is deformed. It is also conceivable that the spacers are designed in such a way that they break in a defined manner when the component is deformed, without causing substantial damage to the working element.

According to the invention, it can be provided that the two adjacent working elements each comprise a shaped section in the region of the adjoining faces, by means of which the distance in the gap region is continuously and/or discontinuously widened. In this way, the course of the gap region can be adjusted to the working element in a targeted manner according to the individual needs and requirements.

A conceivable variant of the invention is such that the carrier comprises a fastening section on one side or on two opposite sides in order to form a bending element clamped on one or both sides. In the case of a bending element clamped on one side, a component that can vibrate strongly is formed, for example a share wing. Bending elements clamped on both sides can be used, for example in filter baskets for rock or oil sand screening plants.

In the case of working tools, for example, a plurality of working elements can be arranged in a row. A constant distance between the working elements can be realized, which enables a simple production. However, it is also conceivable that a varying distance is provided between the working elements. For example, the gap distance can be changed as the distance from the fastening section increases. The gap distance can be set in a targeted manner depending on the individual component deformation to be expected in the region of the respective working element.

The invention can be used in various embodiment variants of working tools. For example, working elements can be used in which a preferably rounded cutting edge is used as the working section. It is also conceivable that the working elements comprise a displacement edge or a breaking edge.

A preferred variant of the invention is such that at least one of the working elements comprises a fastening section with a support section, wherein the fastening section is preferably plate-shaped, that the support section is supported against a bearing surface of the carrier, and that between the bearing surface and the support section, a materially-bonded connection is arranged, at least in some areas, which connects the working element to the carrier. The fastening section serves to securely connect the working element to the carrier. If the fastening section is designed plate-shaped, it can, in particular, directly or indirectly adjoin the working section thereafter, preferably following the cutting edge of the working element. It forms a deflection element there, by means of which removed material can be discharged. In the process, the fastening section then protects the region of the carrier which, following the working section, is exposed to high wear and tear at a high wear pressure.

A preferred working tool can be such that the working section is directly or indirectly connected integrally to the fastening section of the at least one working element, that the fastening section comprises an end remote from the working section, and that the cross-section of the working element tapers at least in some areas continuously and/or discontinuously in the direction from the working section toward the remote end. This creates a material-optimized construction that is adapted to the wear pressure and can reduce the amount of expensive hard material.

It is also conceivable that a projection is integrally formed onto the fastening section, the projection comprising a further support section by which it is supported against a support surface of the carrier, and that a materially-bonded connection is arranged between the support surface and the further support section, the materially-bonded connects the working element to the carrier. The working section is preferably formed in the region of the projection. A materially-bonded connection is held between the projection and the carrier, through which the working forces can be deflected into the carrier thereby. This ensures a reliable support that prevents breakage in the transition region between the projection and the fastening section when strong impact loads act on the working section. In the process, the materially-bonded connection can also act as a buffer with damping effect due to its material properties. The support surface of the carrier is preferably formed by the free end of the carrier.

In such working tools, it is conceivable that the support section of the fastening section and the further support section of the projection merge into one another, thereby forming an angle or a straight line.

A further variant of the invention can be characterized in that the working element comprises a top side which forms a deflection surface, wherein the deflection surface is preferably formed by the fastening section, that the deflection surface merges directly or indirectly into the working section, that a relief surface indirectly or directly adjoins the working section, and that the deflection surface forms a flat surface which, together with the relief surface includes an acute angle, preferably in the range of between 15° and 90° , or that the deflection surface comprises a convex or concave geometry in at least some areas. In the process, the arrangement of the working element on the carrier is preferably such that the deflection surface is arranged at the front on the front side of the carrier in the direction of advancement. The relief surface then extends in such a way that it is oriented opposite to the direction of advancement. This allows a cutting free to be put into effect which reduces the load on the working tool. In addition, a resharpener effect is made possible during operational use, leading to a working edge, in particular a cutting edge, that is always ready to work. In addition, the required towing power for an engine is reduced, which leads to lower fuel consumption. A concave configuration of the deflection surface leads to a reduction in the wear pressure directly adjacent to the working section. A convex configuration of the deflection surface leads to a structure with which improved breaking is put into effect in the soil material to be worked, adjacent to the working section. As has been described above, the working section can form or comprise a cutting edge in particular.

A preferred variant of the invention is such that the spacer is integrally formed in the region of the fastening section of the working element. In conventional soil-working tools, in particular agricultural soil-working tools, the fastening section is thus arranged in the region which, when under a load, is usually arranged on the tension side at a distance from the neutral axis of the carrier. Consequently, the spacers are therefore not unacceptably compressed during operational use.

Furthermore, it is conceivable that the at least one shaped section runs, at least in some areas, in the region of the projection of the working element. In conventional soil-working tools, in particular agricultural soil-working tools, the projection is thus arranged in the region which, when under a load, is usually arranged on the pressure side at a distance from the neutral axis of the carrier. If a deformation takes place during operational use to

the effect that compression is present on the pressure side, destruction of the working elements is reliably excluded.

If it is provided that the working elements each comprise a contact surface by means of which they are placed against a supporting section of the carrier, wherein the supporting section preferably runs parallel to the working section, then the working elements can be positioned on the supporting section for production so that the working sections of the working elements can be aligned with one another reproducibly. This makes exact production possible.

According to the invention, it is preferably provided that the carrier is designed in the form of a sheet or sheet-like, for example also as a forged part. This can mean, in particular, that the thickness "d" of the carrier in relation to the greatest longitudinal extension "L" of the carrier in the working range of the carrier is in the range of between $d/L = 0.02$ to 0.4 . A working tool according to the invention can be characterized in that the spacers are designed as knobs or as ribs. With knobs, for example, point-like system geometries can be realized. With ribs, linear or planar system geometries can be realized. The desired geometry of the spacer can be selected depending on the application.

According to a possible embodiment of the invention, it can be provided that the gap region has a gap height perpendicular to the gap width, the gap height extending between a top side and a bottom side arranged opposite the top side, that a central plane extending perpendicular to the gap height up to half the gap height, and that at least one spacer element is arranged on the side above or below the center plane which faces the tension side of the carrier or that the central plane intersects the at least one spacer element. In this way it is ensured that the spacer element cannot be crushed or only slightly, and thus cannot be damaged in the event of a component deformation.

A working tool according to the invention can be such that the longitudinal extension of the gap region runs perpendicular to the working section. However, it is also conceivable that the longitudinal extension of the gap is at an angle to the working section. This alignment reduces the risk of the gap region being washed out during operational use. For this purpose, it can alternatively also be provided that at least one of the working elements comprises one or more offset pieces that create an angular course of the gap region in the direction of the longitudinal extension of the gap.

A particularly preferred variant of the invention provides that at least one of the spacer elements comprises one or more offset pieces that create an angular course of the gap region or create an offset in the direction of the gap height. This measure can also prevent or reduce a washing out of the gap region during operational use.

For reasons of material savings, it can be provided that the spacer extends only over a partial range of the gap height of the gap region. Furthermore, it can be provided that the spacer is spaced apart from at least one of the end faces of the working element adjoining the gap region.

When using spacers in the bonding material, it has proven, for common soil-working tools, in particular agricultural soil-working machines, to be suitable if it is provided that the particles arranged as spacers in the bonding material have an average diameter in the range between 50µm and 800µm.

The invention is explained in further detail below with reference to exemplary embodiments shown in the drawings. In the drawings:

Figure 1 shows a perspective illustration of a soil-working tool,

Figure 2 shows a wing share of the soil-working tool according to Figure 1 in a perspective illustration,

Figure 3 shows a detail of the tool according to Figure 2 in a side view,

Figure 4 shows a schematic front view of the tool according to Figure 2,

Figure 4a shows a detail illustration taken from Figure 4,

Figure 5 shows a variation of the tool according to Figure 2 in a side view,

Figure 6 shows a detail taken from Figure 5,

Figures 7A to 7C show further details of the tool according to Figure 5,

Figure 8 shows working elements of a working tool arranged in a row, in a top view,

Figure 9 shows a further variant of working elements of a working tool arranged in a row,

Figure 10 shows a further variant of working elements of a working tool arranged in a row.

Figure 1 shows a soil-working tool 20, namely a wing share for an agricultural soil-working machine. Such soil-working tools 20 are used to work an agricultural area 60, into the surface 61 of which the soil-working tool 20 penetrates. The agricultural soil-working machine comprises a leg 10 on which the wing share is mounted. The soil-working tool 20 comprises a cultivator tip with a base part 21 made of a steel material. The base part 21 is provided with screw receptacles 22.

Furthermore, the base part 21 comprises a working element 25 at its free end. This working element 25 is formed by at least one hard material element which is connected to the base part 21. For example, the working element 25 can be a hard metal element that is materially bonded, preferably soldered, to the base part 21. The working element 25 includes a cutting edge which forms the free end of the working element 25. The working element 25 comprises a plate-shaped fastening section. This plate-shaped fastening section is connected integrally to a rear projection which can be at an angle to

the plate-shaped fastening section. The working element 25 is fixed to the base part 21 both at the plate-shaped fastening section and at the rear projection by way of solder material. The rear projection of the working element 25 is supported on the free end of the base part 21 by way of solder material. As Figure 1 shows, a plurality of working elements can be provided in a row side by side. This reduces the risk of breakage of the working elements.

Furthermore, protective elements 23 can be provided at the share tip. In the present exemplary embodiment, the protective elements 23 are arranged following the working elements 25. The protective elements 23 then protect, at least in some areas, the part of the base part 21 that adjoins the working elements 25. Furthermore, it can optionally be provided that the protective elements 23 comprise lateral edges 24 that serve as lateral cutting edges in order to put into effect a lateral cutting free.

As Figure 1 further shows, a guide element 30 is fixed to the leg 10. The guide element 30 consists of a steel material and is arranged on the front side, that is to say on the leg 10 at the front in the direction of advancement v. The guide element 30 comprises a deflection surface 31 facing away from the leg 10. The deflection surface 31 can be curved and/or spiraled. The guide element 30 can comprise an end-side plug-in projection 33 facing the share tip, the projection being inserted into a plug-in receptacle 26 formed on the rear of the share tip. A cover section of the share tip covers the end of the guide element 30 and protects it. The guide element 30 can comprise a fastening receptacle 32, for example. The guide element 30 can be fixed, to the leg 10 using a nut 11 by means of a fastening screw which is inserted through the fastening receptacle 32 and a screw receptacle of the leg 10 aligned therewith. The share tip is also screwed to the leg 10, for which purpose one or more fastening receptacles 22 can be used. It is also conceivable that a fastening receptacle 22 is also used at the same time to fasten the free end of the guide element 30 on the leg 10. For this purpose, a fastening screw is inserted through the fastening receptacles 22 and the fastening receptacles of the guide element 30 and the leg 10, which are aligned with them.

As Figure 1 further shows, working tools 40 are fixed to both sides of the leg 10. The working tools 40 in the present case are designed as wing shares. The working tools 40 comprise a carrier 41 to which a fastening section 42 is connected. The working tool 40 can be screwed to the leg 10 using screws 43 (fastening receptacles 42.1 for the screws 43).

In Figure 2 the working tool 40 is shown in detail. As this illustration illustrates, the fastening section 42 is connected to the carrier 41 via a transition section 47. The fastening section 42 is preferably bent away from the carrier 41.

The carrier 41 can be formed from a sheet-like component.

The carrier 41 comprises an end section 41.1, which is turned away from the fastening section 42. The carrier 41 includes a top side 44 and an opposite bottom side 45. Furthermore, the carrier includes a rear side 41.2 at its rear end oriented opposite to the direction of advancement V. Facing the direction of advancement, the carrier 41 includes a working element receptacle 46. This working element receptacle 46 can be cut out of the carrier 41, for example in the form of a milled cutout.

A plurality of working elements 50 are attached to the carrier 41. The working elements 50 consist of a hard material, preferably hard metal. The working elements 50 each comprise a working section 51. The working sections 51 of the working elements 50 merge into one another and form a common, preferably continuous working section.

In Figure 3, a detailed view of the working tool 40 according to Figure 2 is illustrated. As this illustration shows, the working element receptacle 46 is introduced into the carrier 41 or cut out of it. The working element receptacle 46 forms a bearing surface 46.1. A supporting section 46.2 is provided at the rear. The working elements 50 can be fixed in or on the working element receptacle 46. The connection of the working elements 50 to the carrier 41 preferably takes place by means of a materially-bonded connection, preferably by means of a hard solder connection. The working elements 50 are provided with a support side 53 on their bottom sides. By means of this support side 53, the working elements 50 are placed on the bearing surface 46.1 of the carrier 41 by way of solder material. Opposite the support side 53, the working elements 50 form a top side 52. This top side 52 serves as a deflection surface following the working section 51. Cut soil material can be deflected via the deflection surface.

The working elements 50 include a contact surface 54 in their rear region. With this contact surface 54, the working elements 50 can be precisely aligned on a supporting section 46.2 of the carrier.

The working elements 50 comprise tapering sections 52.1, 53.1. By means of these tapering sections 52.1, 53.1, the top side 52 and/or the support side 53 merge into one or a plurality of the side surfaces of the working element 50. This measure can be provided for all working elements according to the invention.

In the embodiment according to Figure 3 the rear contact surface and the side surfaces which are perpendicular thereto merge, via the tapering sections 52.1 and 53.1, into both

the top side 52 and the support side 53. Furthermore, tapering sections 52.1, 53.1 are provided on the front working section 51. The tapering sections 52.1 in the region of the top side 52 reduce the risk of breakage in the corner regions of the working element. The tapering sections 52.1, 53.1 can, as is shown, for example, in the design according to Figure 3, be designed as milled edges. It is also conceivable that roundings are provided. As Figure 3 shows, the working elements 50 can be inserted into a pocket-shaped working element receptacle 46. This pocket-shaped working element receptacle 46 is delimited in the region of the front side by a material section of the carrier 41. At the rear, the working element receptacle 46 is delimited by the contact surface 54.

Shown in Figure 3 is the neutral axis NFT of the carrier 41. This neutral axis forms a plane that is formed between the top side 44 and the bottom side 45. The carrier 41 can be bent about this neutral axis NFT when there is a load on the end section 41.1 of the carrier 41. In the illustration according to Figure 2, if, in the event of a load from above, the carrier 41 is bent on the end section 41.1, the maximum distance between the support side 53 and the neutral axis NFT is on the pressure side h_1 . The maximum distance between the support side 53 on the tension side is h_2 .

In Figure 4 the arrangement of the working elements 50 on the carrier 41 is shown schematically, wherein a view perpendicular to the working section 51 has been selected. As this illustration shows, the working elements 50 are arranged in a row with a gap region SP. A spacer 55 is integrally formed onto each of the working elements 50 on one side (in the present embodiment on the right side). The spacer 55 is designed integrally together with the working element 50. The spacers 55 bridge the distance in the gap region SP to the adjacent working element 50. Accordingly, the adjacent working elements 50 form adjoining faces that face one another in the gap region SP. The gap region SP is bridged by the spacer 55. The fastening of the working elements 50 on the carrier 41 takes place by means of a materially-bonded connection, for example by means of a hard solder connection. For purposes of production, a solder material is positioned between the carrier 41 and the support side 53 of the working elements 50 on the carrier 41. The working elements 50 are arranged in a row on the solder material. This composite is then placed in a furnace. The pre-mounted unit is brought to the soldering temperature in the soldering furnace. The solder material melts. It then flows into the region between the support side 53 and the bearing surface 46.1. In addition, the solder material also flows into the gap region SP and at least partially fills it. The spacers 55 guarantee a minimum gap width in the gap region SP.

If, as shown in Figure 4, a bending of the carrier 41 now takes place while it is used for working, and this bending leads to a compression of the carrier 41 above the neutral axis NFT on the region facing the top side 44, a shift in the working elements 50 also takes place due to the bending of the carrier 41. This shift reduces the gap region 50 in the region of the top side 52 of the working elements 50, whereas the gap width in the region of the support side 53 is increased. In the process, the spacers 55 guarantee that the working elements 50 do not touch in the region of the top side 52. In this way, crushing of the working elements 50 and an associated damaging of the working elements 50 is prevented.

The spacers 55 can be designed as knob-shaped prominences, as shown in Figure 4. It is also conceivable, as is illustrated in Figure 4A, that the spacers 55 are configured as ribs which protrude laterally from the working elements on one or both sides. The spacers 55 preferably extend only over a partial region of the height of the working elements 50 in the gap region SP, as shown in Figure 4A. It is also preferred if the spacers 55 are shaped in such a way that they are arranged at a distance x from the top side 52 and at a distance y from the support side 53. This ensures that the spacers are not damaged when a deformation of the carrier 41 occurs, for example according to Figure 4. The spacers 55 are particularly preferably arranged in such a way that they intersect the central transverse plane MQ of the working elements 50 at half their height.

In Figures 5 and 6, an alternative configuration of the working tool 40 according to Figures 1 to 4 is shown. This variant differs from the variant described previously in the structuring of the working elements 50. To avoid repetitions, reference is made to the above explanations with regard to the features that do not change.

The working elements 50 comprise a plate-shaped fastening section which forms the support section 53.2. The working elements 50 rest on a bearing surface 46.1 of the carrier 41 using this support section 53.2. Once again, the working element receptacle 46 can be designed as a milled cutout on the carrier 41. The support section 53.2 merges into a further support section 53.2.2 in the region of the free end 41.3 of the carrier 41. In the process, the support section 53.2 and the further support section 53.2.2 are at an angle relative to one another. The further support section 53.2.2 stands opposite the free end 41.3 of the carrier 41.

As Figure 6 also shows, the top side 52 of the working elements 50 merges into a rear relief surface 57 via the working section 51. In the process, the rear relief surface 57 and the top side 52 of the fastening section form an acute angle.

A soldered connection can again be used to fasten the working elements 50 on the carrier 41. In the process, the solder connection is arranged between the support section 53.2, or the further support section 53.2.2, and the bearing surface 46.1, or the free end 41.3, of the carrier 41.

As shown in Figures 7A to 7C, the working elements 50 are arranged in a row. A gap region SP is maintained between the working elements 50. This gap region SP is at least partially bridged by spacer 55.

According to the exemplary embodiment according to Figure 7A, two spacers 55 are integrally formed onto each working element 50 on an adjoining face. The spacers 55 lie against the opposite adjoining face of the adjacent working element 50. In the process, the spacers 55 are positioned in the region of the working section 51. Furthermore, shaped sections 59 are provided on the working elements 50 on the adjoining faces. The gap region is continuously widened by means of these shaped sections 59. The shaped sections 59 run in the region of the projections 56.

Figure 7B shows an alternative configuration variant to Figure 7A, in which one spacer 55 per adjoining face, respectively, is used on a working element 50. As a result, the spacers 55 of two adjacent working elements 50 oppose one another in the region of their adjoining faces. Opposite one another in the gap region SP. The assignment can be made in such a way that, in principle, a picture as in Figure 7A results, wherein two spacers 55 are arranged at a distance from one another in the gap region SP. However, it is also conceivable that the spacers 55 touch, as Figure 7B shows.

In Figure 7B it is further illustrated that shaped sections 59 can also be provided in the embodiment variant shown here, by means of which the gap region SP is widened. In Figure 7B an operating position is also shown in which the carrier 41 on which the working elements 50 are mounted is bent in the operating position, wherein according to Figure 2 the bend runs in such a way that the bottom side 46 is compressed and the top side 44 is arranged in the region of the tension side of the neutral axis NFT of the carrier 41. As the illustration shows, the shaped sections 59 prevent the working elements 50 from touching in the gap region SP in the event of such a deformation.

In Figure 7C the opposite bending direction is shown. Here, the spacers 55 prevent the working elements 50 from unacceptably touching one another in the gap region SP and from being damaged.

In Figure 8 an embodiment variant is shown in which two or more spacers 55 can also be arranged one after the other.

Figure 9 shows a configuration variant in which the working elements 50 can comprise offset pieces 52.2 integrally formed thereon. These offset pieces 52.2 create an angular course of the gap region SP in the direction of the longitudinal extension of the gap. As a result, the gap region SP is better protected from being washed out.

It is additionally or alternatively also conceivable that according to Figure 10 at least one of the spacer elements 50 comprises one or more offset pieces 52.2 which create an angular course of the gap region SP or an offset in the direction of the gap height. This also provides protection against washing out.

As Figure 10 shows, the gap region SP can also be configured so that a varying gap width is realized.

In the exemplary embodiment shown in Figure 10, the gap region has, in the region facing the top side 52, a larger gap width b_2 than in the region facing the support side 53 (gap width b_1).

It is conceivable that this varying gap width is realized via the one or the plurality of offset pieces 52.2.

As further shown in Figure 10, the gap width b_1 is realized in the region facing the support side 53 by means of the spacer 55. The offset pieces 52.2 are structured such that the gap region SP then widens in the transition region formed by the offset pieces 52.2. Following the offset pieces 52.2, the gap region SP can then be widened further to the gap width b_2 . It is conceivable that the gap width in the region of the offset pieces 52.2 is equal to the gap width b_2 or deviates therefrom.

The offset pieces 52.2 are preferably arranged in the region of the central transverse plane of the working elements 50 formed centrally between the top side 52 and the support side 53. This results in an improved strength behavior under bending stress. However, it is also conceivable that the offset pieces 52.2 are arranged closer together in the region of the support side 53, i.e., below the central transverse plane. As a result, the effective region of wear can be enlarged until the top side 52 is worn down to the region of the offset pieces 52.2.

If improved protection against washing out of the gap region SP is desired, the gap region SP defined by the offset pieces 52.2 can also be laid out closer to the region of the top side 52 above the central transverse plane.

DRIFTSVÆRKTØJ, I SÆRDELESHED JORDBEHANDLINGSVÆRKTØJ**Patentkrav**

1. Driftsværktøj (40), i særdeleshed jordbehandlingsværktøj, fortrinsvist jordbehandlingsværktøj til landbrug, med en holder (41), der i området ved en driftsside har mindst to driftselementer (50), hvorved driftselementerne (50) består af et hårdt materiale, i særdeleshed hårdmetal eller disse har et hårdt materiale, hvorved driftselementerne (50) har et driftsafsnit (51), og hvorved driftselementerne (50) er fastgjort på række med hinanden på holderen (41), fortrinsvist støbt, hvorved siderne med rækkerne i det mindste i forhold til en del af de tilstødende driftselementer (50) i rækkeområdet, og i det mindste i et område ad gangen under dannelse af et område med mellemrum (SP) ligger over for hinanden med afstand, kendetegnet ved, at mindst et af driftselementerne (50) har en afstandsholder (55), der holder driftselementerne (50) på afstand under dannelse af området med mellemrum (SP), og at afstandsholderen (55) ligger op til driftselementet (50) overfor, og/eller kendetegnet ved, at mindst et af de tilstødende driftselementer (50) i området med rækkesiden har et konturafsnit (59), ved hjælp af hvilket afstanden i området med mellemrum (SP) udvides kontinuerligt og/eller diskontinuerligt, hvorved bredden på mellemrummet forstørres med tiltagende afstand fra en neutral fiber (NFT), omkring hvilken en komponentbøjning af holderen (41) finder sted.

2. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at den mindst ene afstandsholder (55) i det mindste i et område ad gangen er anbragt i området med mellemrum (SP), hvorved det fortrinsvist kan fastsættes, at området med mellemrum (SP) i det mindste delvist fyldes ved hjælp af et forbindelsesmateriale, eksempelvis ved hjælp af et loddemateriale eller et klæbemateriale og at afstandsholderen (55) i det mindste i et område ad gangen er indlejret i forbindelsesmaterialet.

3. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at det ene eller de to tilstødende driftselementer (50) i det mindste har en tilpasset afstandsholder (55), og/eller at driftselementerne (50) på sider over for hinanden hver især mindst har en

afstandsholder (55) eller at driftselementerne (50) kun har en afstandsholder (55) på den ene side.

4. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at de to tilstødende driftselementer (50) i området med rækkesiden hver især har et konturafsnit (59), ved hjælp af hvilket afstanden i området med mellemrum (SP) udvides kontinuerligt og/eller diskontinuerligt.

5. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at holderen (41) på en side eller på to sider, der ligger over for hinanden, har et fastgørelsesafsnit (42) for at danne et bøjningselement, der er spændt ind i den ene side eller på begge sider, hvorved det i særdeleshed kan fastsættes, at holderen (41) i den ene side har et fastgørelsesafsnit (42) til fastgørelse på en driftsmaskine, at holderen (41), som ligger over for fastgørelsesafsnittet (42) har en udragende ende med et endefsnit (41.1), og at rækken af driftselementer (50), der ligger på række med hinanden, i det mindste strækker sig i et område ad gangen mellem fastgørelsesafsnittet (42) og endefsnittet (41.1).

6. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at driftselementerne (50) som driftsafsnit (51) har en fortrinsvist afrundet skærekant, en fortrængningskant eller en brudkant.

7. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at i det mindste et af driftselementerne (50) har et fastgørelsesafsnit med et støtteafsnit (53.1), hvorved fastgørelsesafsnittet fortrinsvist er udformet i pladeform, at støtteafsnittet (53.1) er afstivet over for en holdeflade (46.1) på holderen (41), og at der mellem holdefladen (46.1) og støtteafsnittet (53.1) i det mindste i et område ad gangen er anbragt en støbt forbindelse, der forbinder driftselementet (50) med holderen (41).

8. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at driftsafsnittet (51) er indirekte eller direkte komplet tilsluttet på fastgørelsesafsnittet på det i det mindste ene driftselement (50), at fastgørelsesafsnittet har en ende, der vender væk fra driftsafsnittet (51), og at tværsnittet på driftselementet (50) tilspidses i en retning fra driftsafsnittet (51) i en retning mod den bortvendte ende i det mindste kontinuerligt og/eller diskontinuerligt.

9. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at der på fastgørelsesafsnittet er tilpasset en ansats (56), der har et yderligere støtteafsnit (53.2.2), med hvilket det støttes over for en støtteflade på holderen (41), der fortrinsvist dannes fra den frie ende (41.3) af holderen (41), og at der mellem støttefladen og det yderligere støtteafsnit (53.2.2) er anbragt en støbt forbindelse, der forbinder driftselementet (50) med holderen (41), hvorved det i særdeleshed kan fastsættes, at støtteafsnittet (53.1) på fastgørelsesafsnittet og det yderligere støtteafsnit (53.2.2) på ansatsen (56) går ind i hinanden under dannelse af en vinkel eller retlinet.

10. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at driftselementet (50) har en overside (52), der danner en afledningsflade, hvorved afledningsfladen fortrinsvist er dannet af fastgørelsesafsnittet, at afledningsfladen overgår indirekte eller direkte i driftsafsnittet (51), at en frigangsflade (57) tilslutter sig indirekte eller direkte til driftsafsnittet (51), og at afledningsfladen danner en plan flade, der omfatter en spids vinkel med frigangsfladen (57), fortrinsvist i området mellem 15° og 90° , eller at afledningsfladen har en konveks eller konkav geometri i det mindste i et område ad gangen.

11. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at afstandsholderen (55) er tilpasset i området ved fastgørelsesafsnittet på driftselementet (50), og/eller at konturafsnittet (59) i det mindste i et område ad gangen forløber i området ved ansatsen (56) til driftselementet (50).

12. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at driftselementerne (50) hver især har en anlægsflade (54), ved hjælp af hvilken de er lagt på et anlægsafsnit (46.2) af holderen (41), hvorved anlægsafsnittet (46.2) fortrinsvist forløber parallelt med driftsafsnittet (51), og/eller at holderen (41) er udformet i form af en metalplade eller i metalpladeform, eksempelvis også som en smedet del, og/eller at afstandsholderne er udformet som nopper eller som stivere.

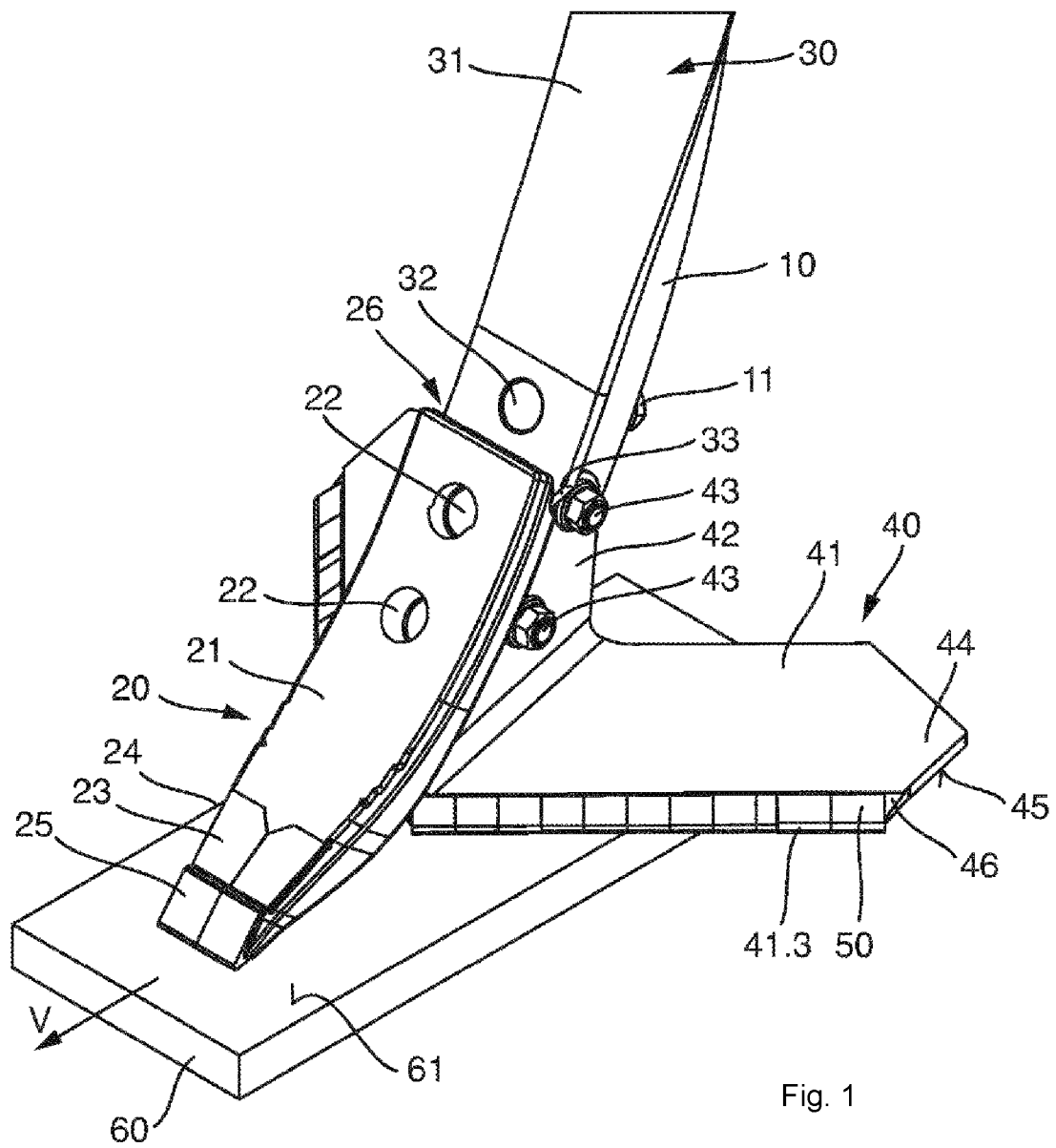
13. Driftsværktøj (40) ifølge et af kravene 1 til 12, kendetegnet ved, at området med mellemrum (SP) har en mellemrumshøjde lodret i forhold til mellemrumsbredden, der strækker sig mellem en overside (52) og en underside, der er anbragt over for oversiden

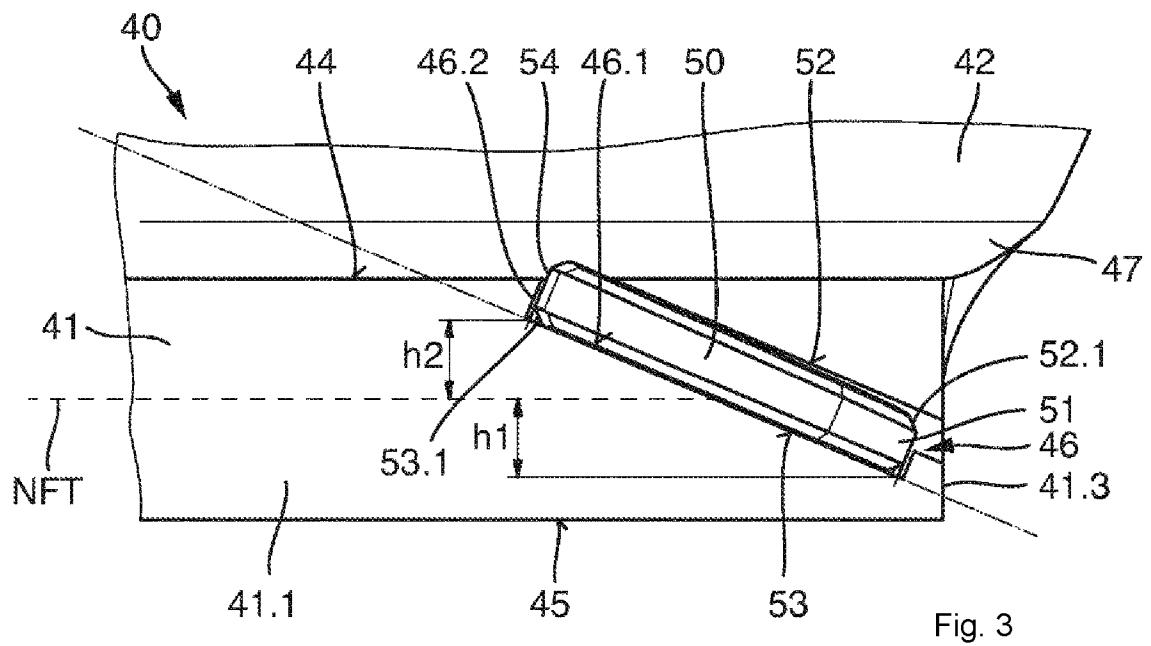
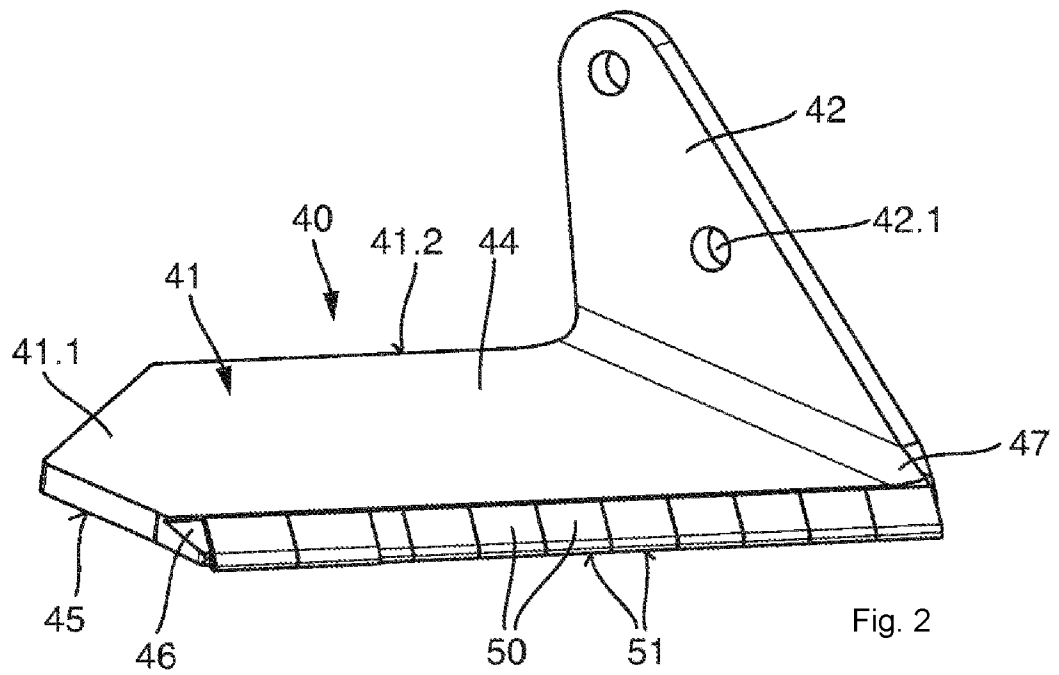
(52), at der i halv mellemrumshøjde er anbragt et midterplan, der strækker sig lodret i forhold til mellemrumshøjden, og at det i det mindste ene afstandselement (55) er anbragt på siden over eller under midterplanet, der er vendt mod træksiden på holderen eller at midterplanet afskærer det i det mindste ene afstandselement (55).

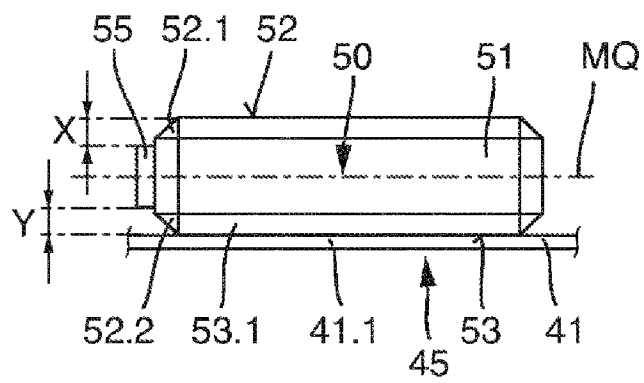
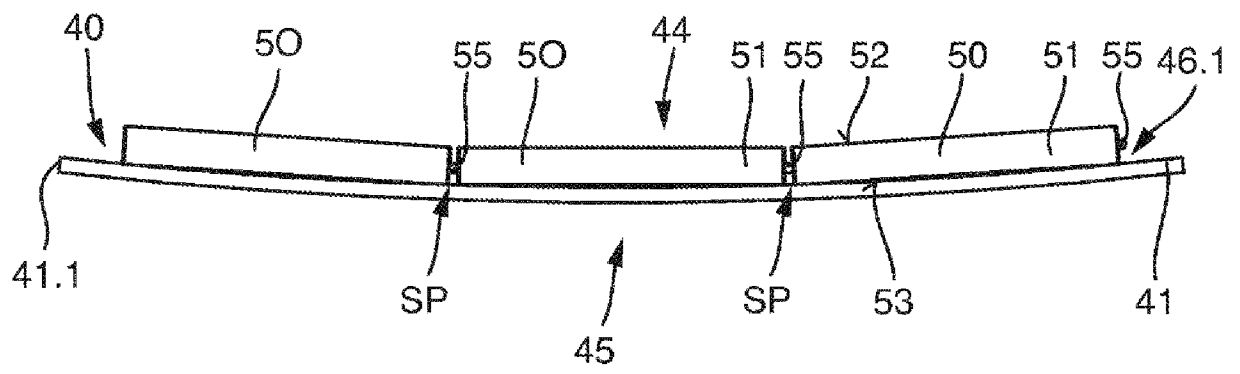
14. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at området med mellemrum (SP) med sin udstrækning af mellemrumslængden forløber lodret i forhold til driftsafsnittet (51) eller ligger i en vinkel hertil eller at i det mindste et af driftselementerne (50) har et eller flere forskydningsstykker (52.2), der skaber et vinkelformet forløb af området med mellemrum (SP) i retning mod udstrækningen af mellemrumslængden.

15. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at i det mindste et af afstandselementerne (50) har et eller flere forskydningsstykker (52.2), der skaber et vinkelformet forløb af området med mellemrum (SP) eller en forskydning i retning mod mellemrumshøjden, og/eller at afstandsholderen (55) kun strækker sig over et delområde af mellemrumshøjden i området med mellemrum (SP) og hvorved det fortrinsvist kan fastsættes, at afstandsholderen (55) ligger i afstand til mindst en af de endeflader på driftselementet (50), der tilsluttes til området med mellemrum (SP).

16. Driftsværktøj (40) ifølge et af de foregående krav, kendetegnet ved, at der i området med mellemrum (SP) er anbragt et forbindelsesmateriale med en støbt forbindelse, hvorved der i forbindelsesmaterialet er anbragt partikler som afstandsholder (55), og at de anbragte partikler som afstandsholder (55) i forbindelsesmaterialet har en gennemsnitlig diameter i området mellem 50µm og 800µm.







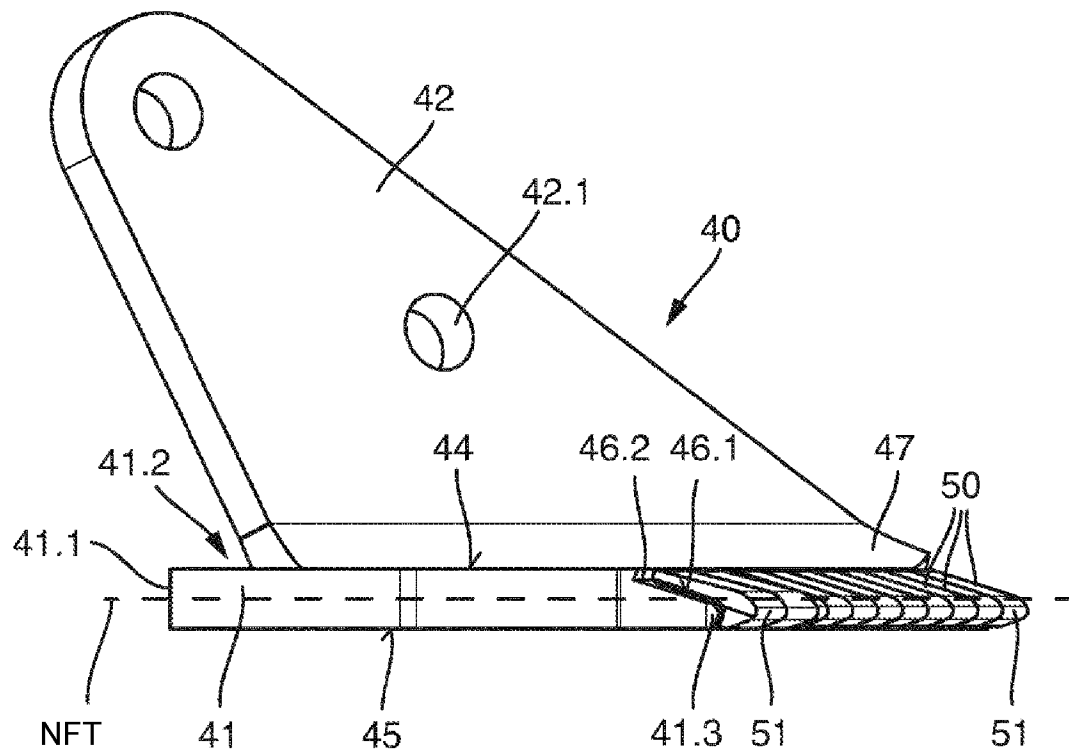


Fig. 5

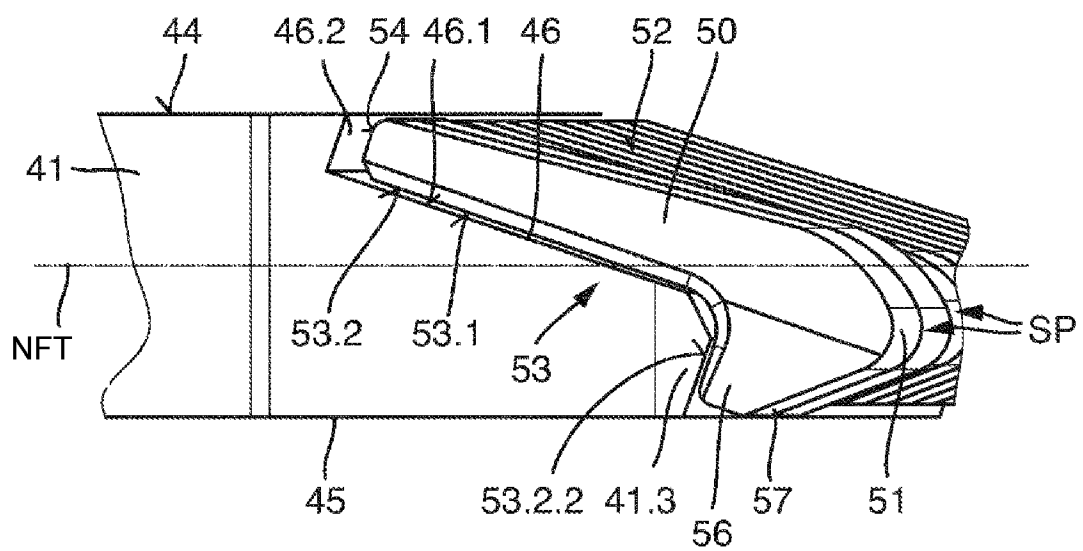
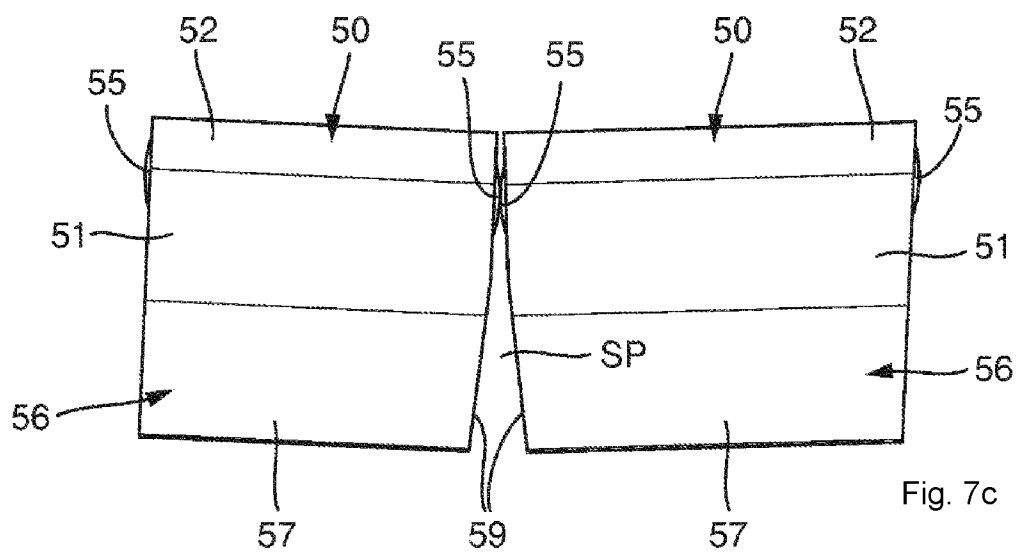
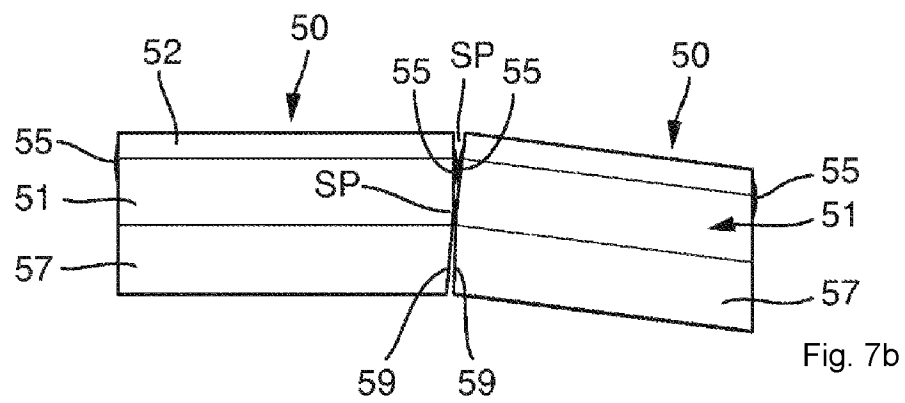
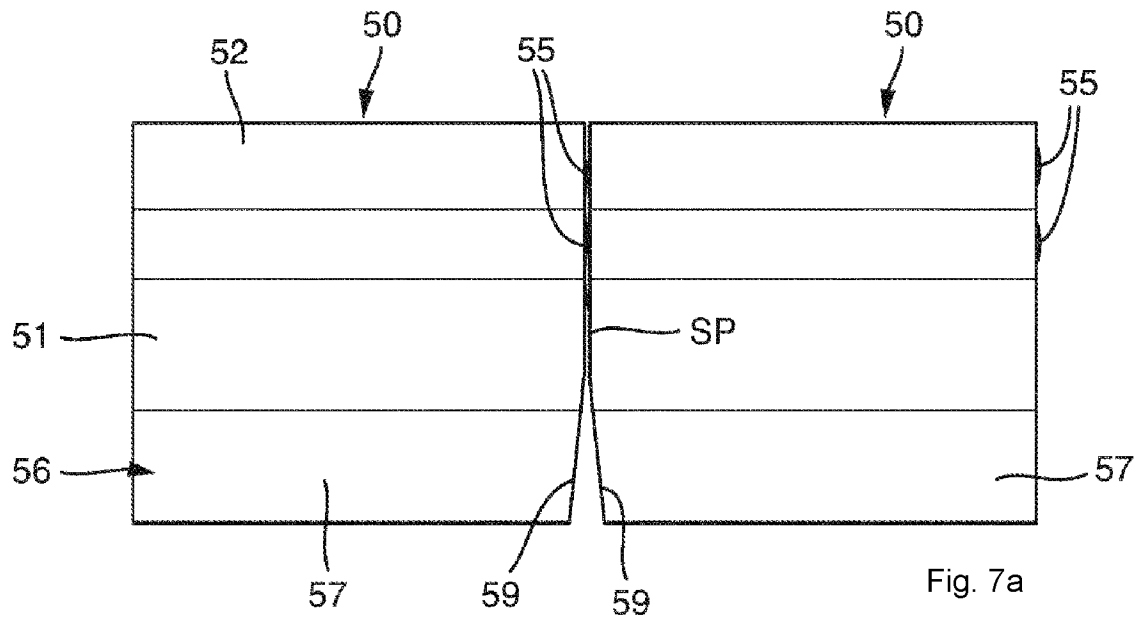


Fig. 6



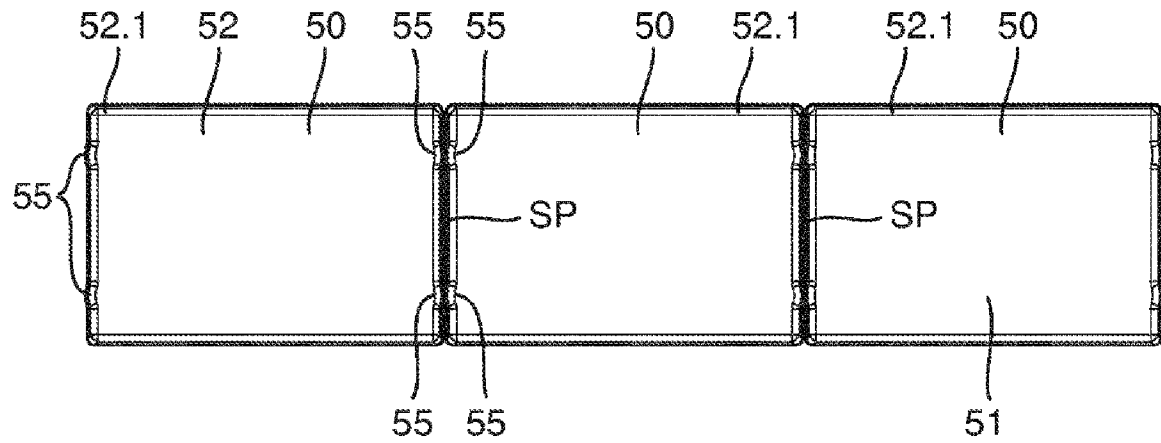


Fig. 8

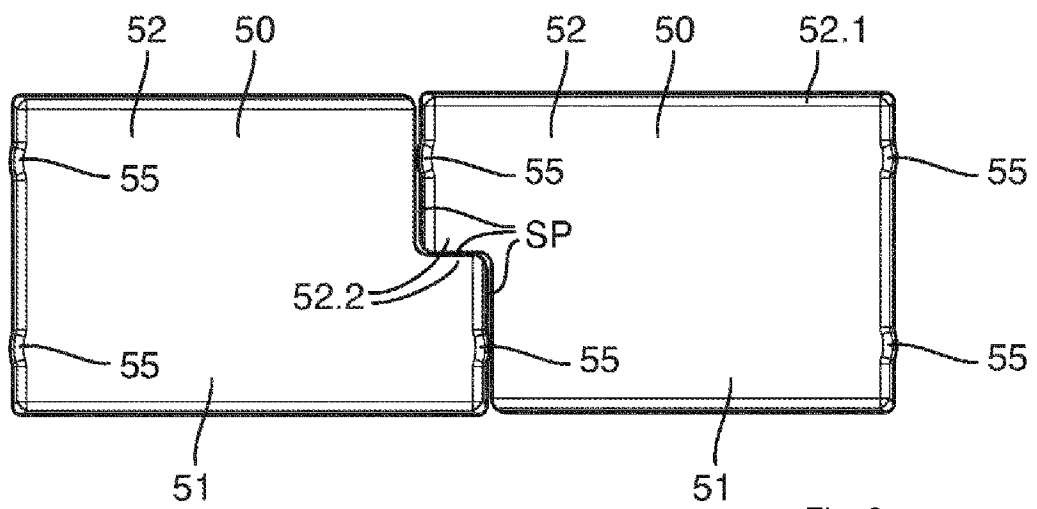


Fig. 9

