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REPUBLICATION

(54) **CUTTING BLADE**

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(57) **ABSTRACT**

The present invention relates to a cutting blade such as a kitchen knife blade. The cutting blade comprises a cutting edge, a spine and opposite side surfaces. A tapered portion of the blade extends longitudinally and adjacent to the cutting edge in which a thickness of the blade defined as a transverse distance between the opposite side surfaces tapers towards the cutting edge. The cutting blade includes one or more broad recesses provided in one or more side surfaces of the blade, wherein at least one of the broad recesses is bounded at vertically opposite sides by the tapered portion and the spine and at longitudinally opposite sides by narrow supporting elements extending from the spine to the tapered portion. Embodiments of the cutting blade have a substantially reduced average wedge thickness which reduces cutting resistance to due to the wedging effect. Embodiments of the cutting blade provide a reduced total surface area of the one or more sides surfaces in contact with an item being cut by the blade which reduces cutting resistance due to friction between the side surfaces of the blade and the item. The present invention also provides for methods of forming a cutting blade, such as by near-net or additive manufacturing techniques.

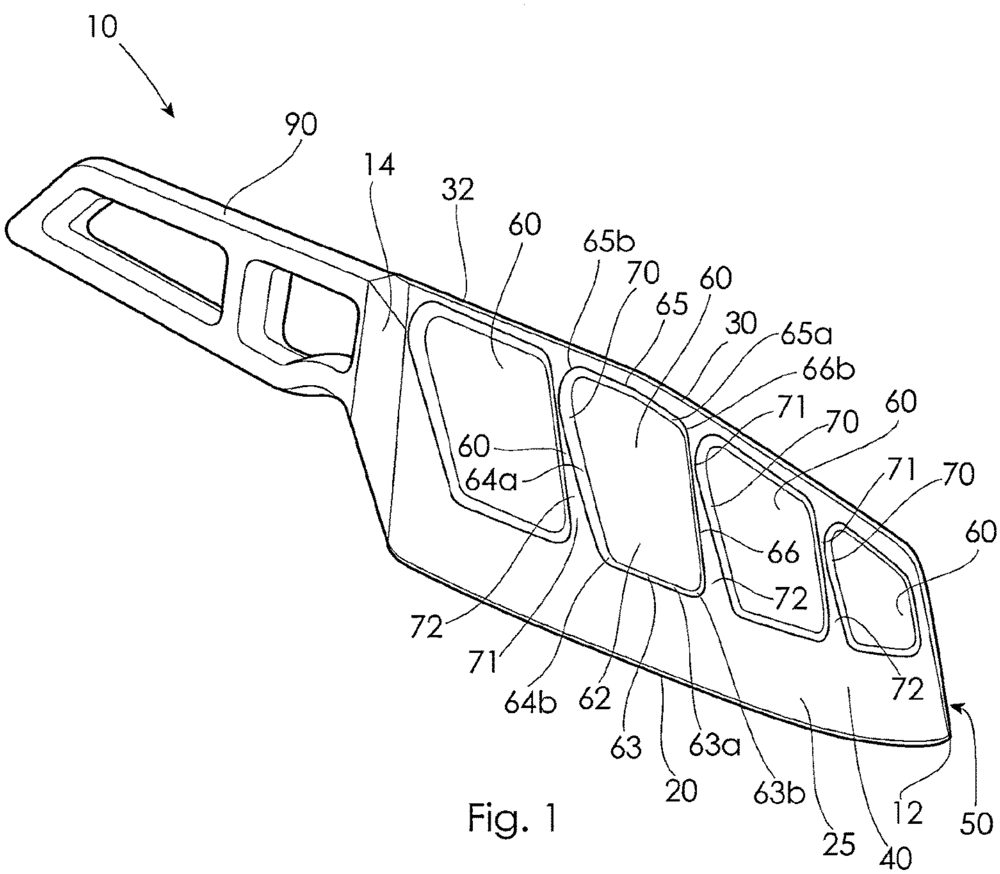
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Fig. 1

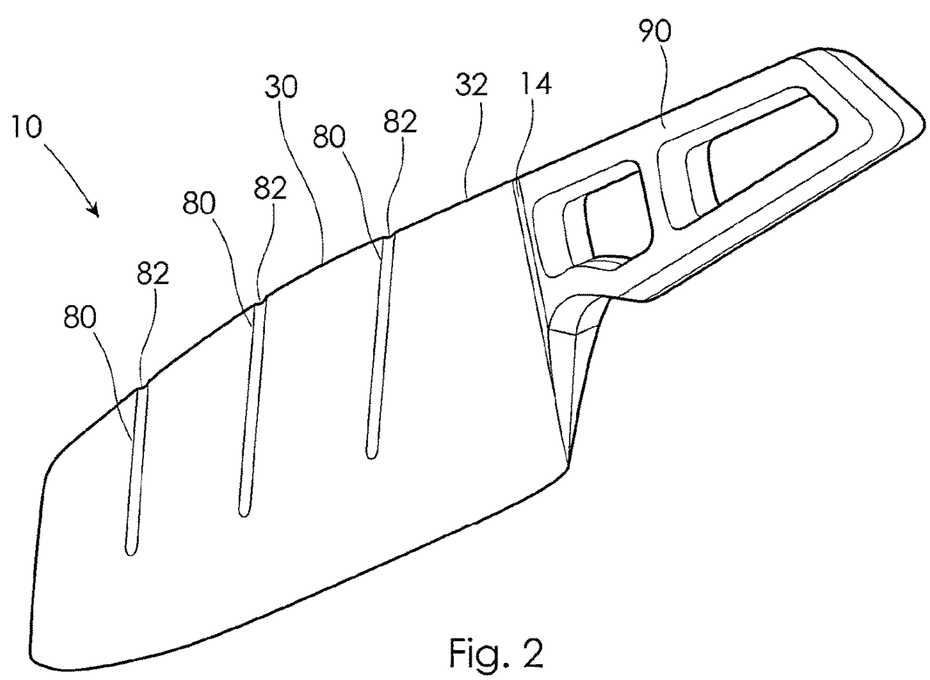
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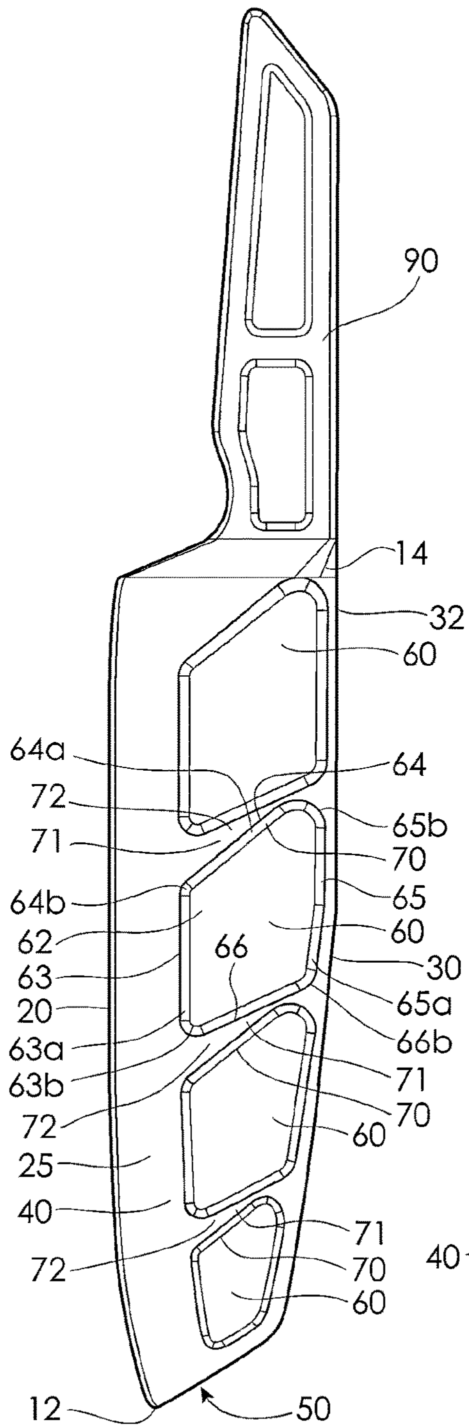
Fig. 2



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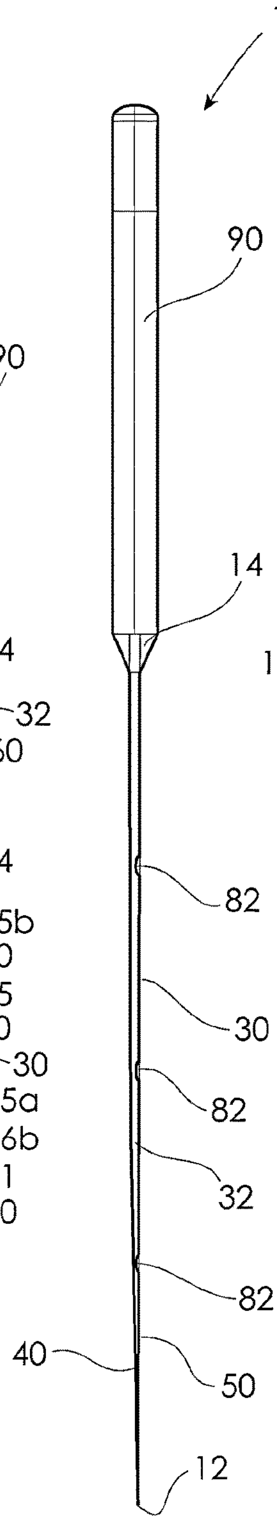

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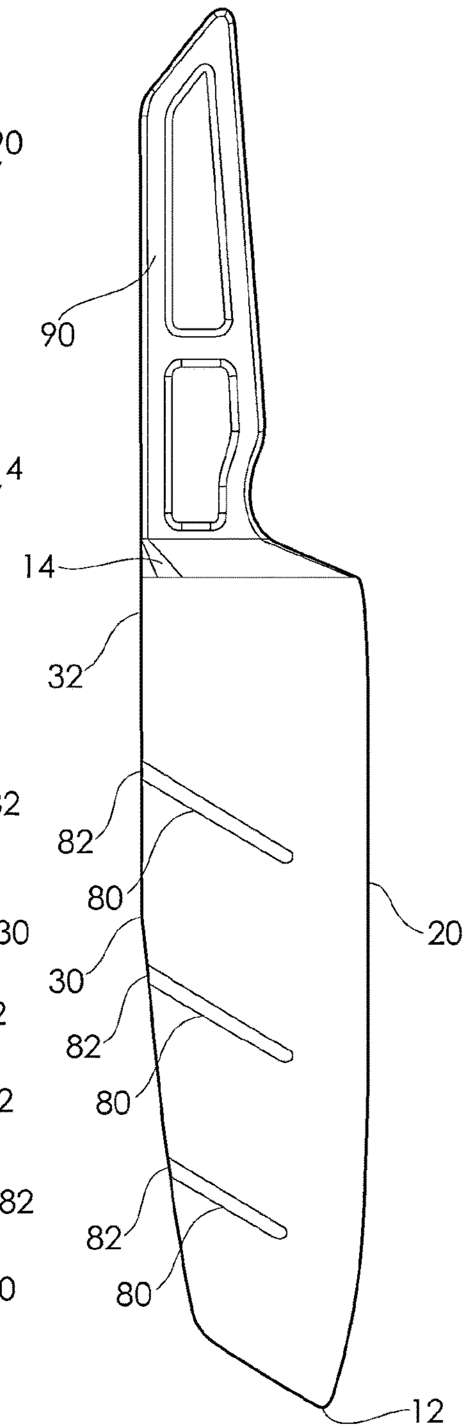

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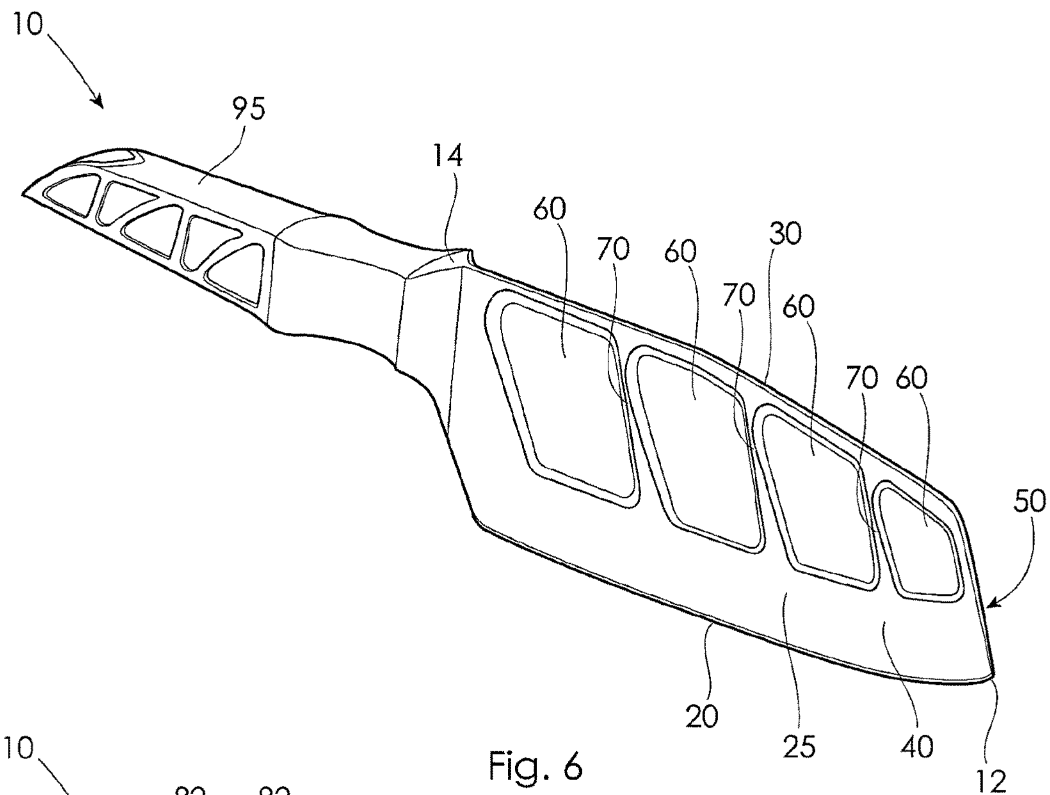
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Fig. 6

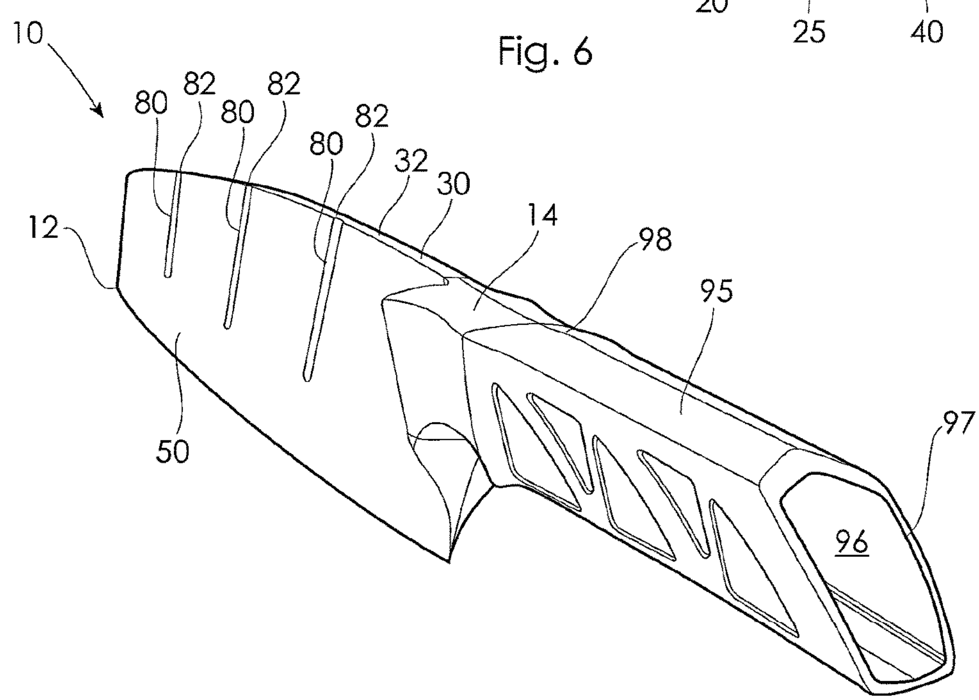
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Fig. 7

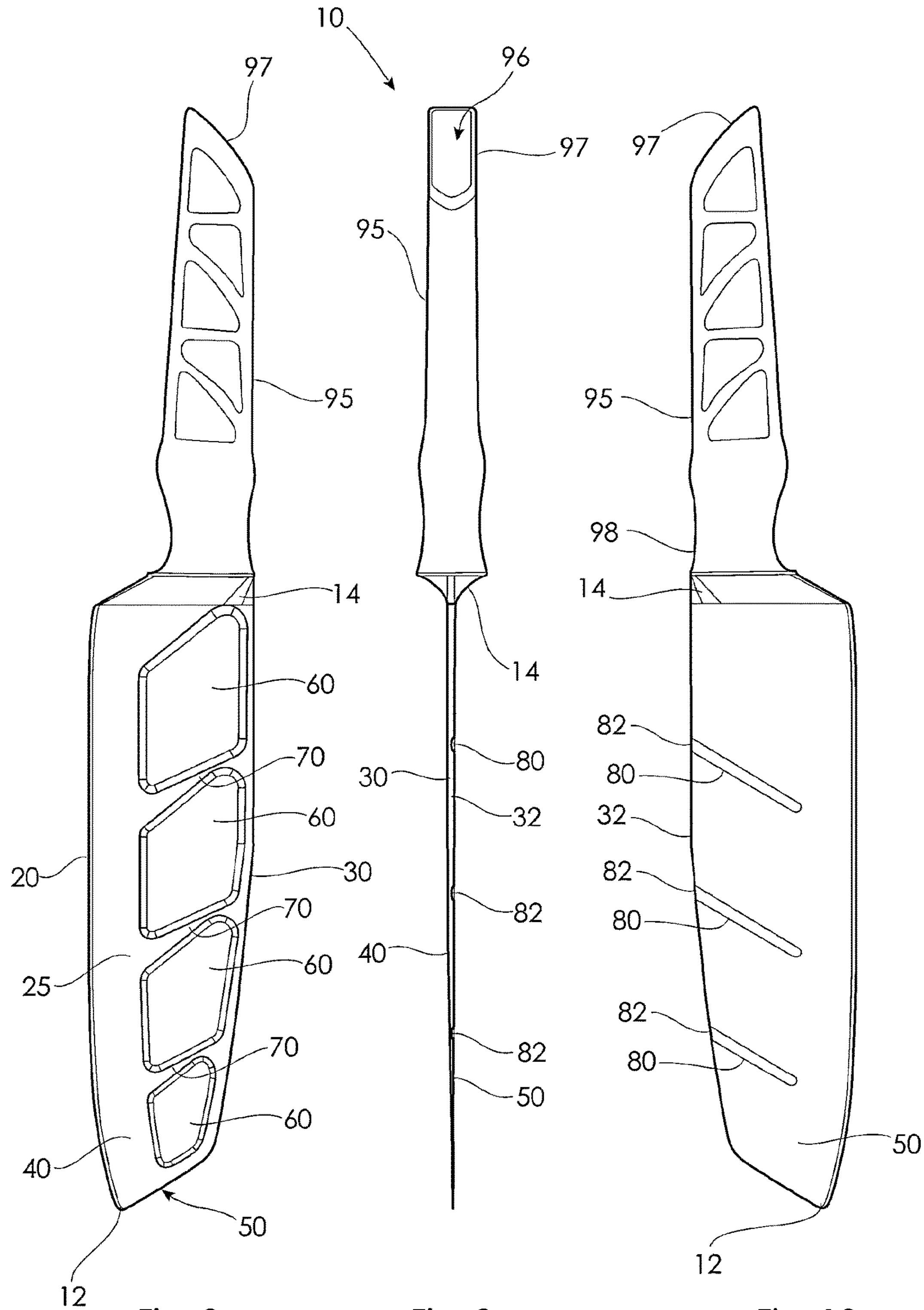
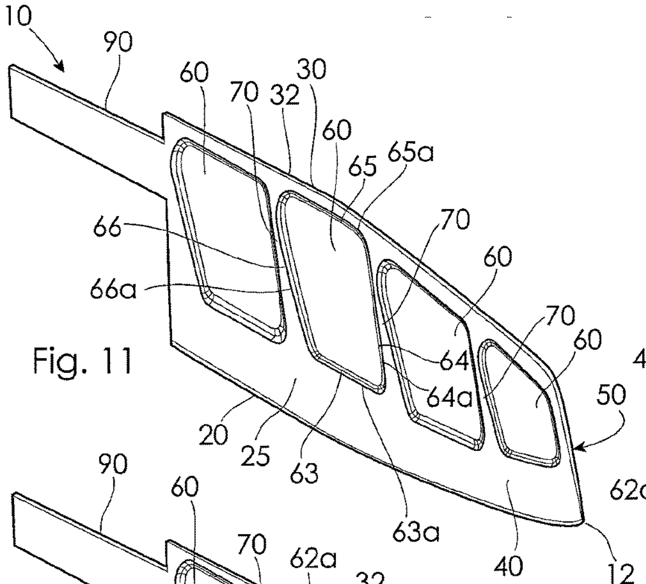


Fig. 8 Fig. 9 Fig. 10



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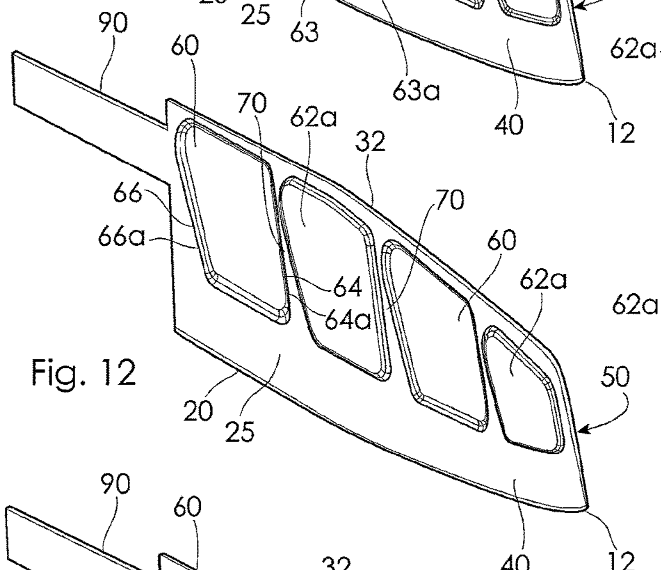

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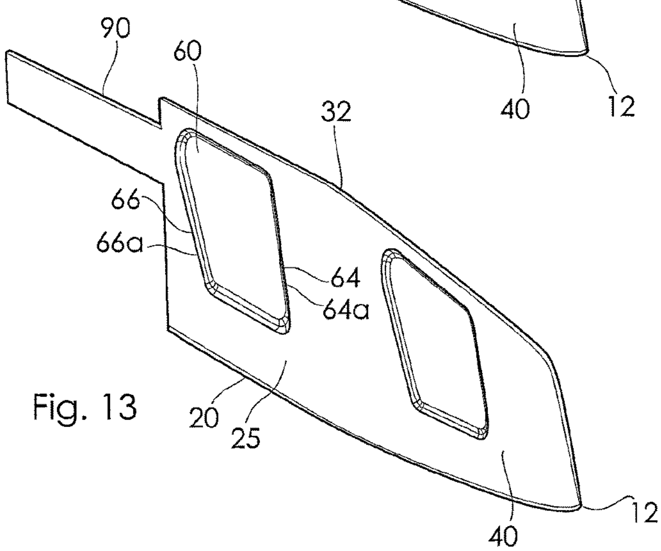

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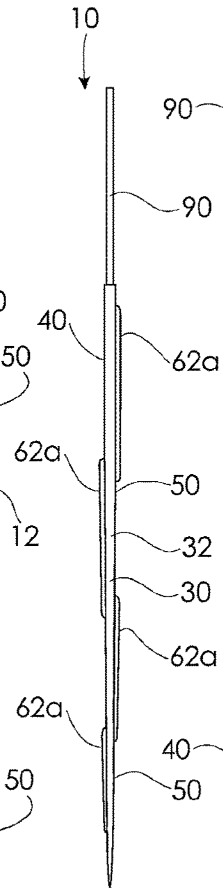

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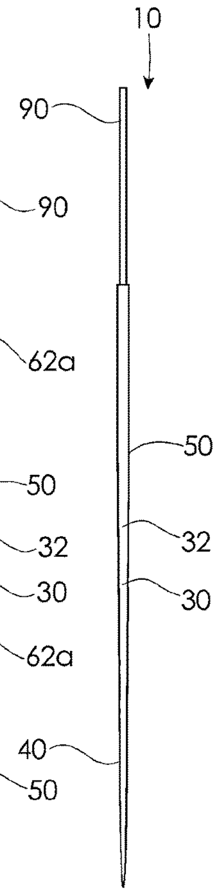

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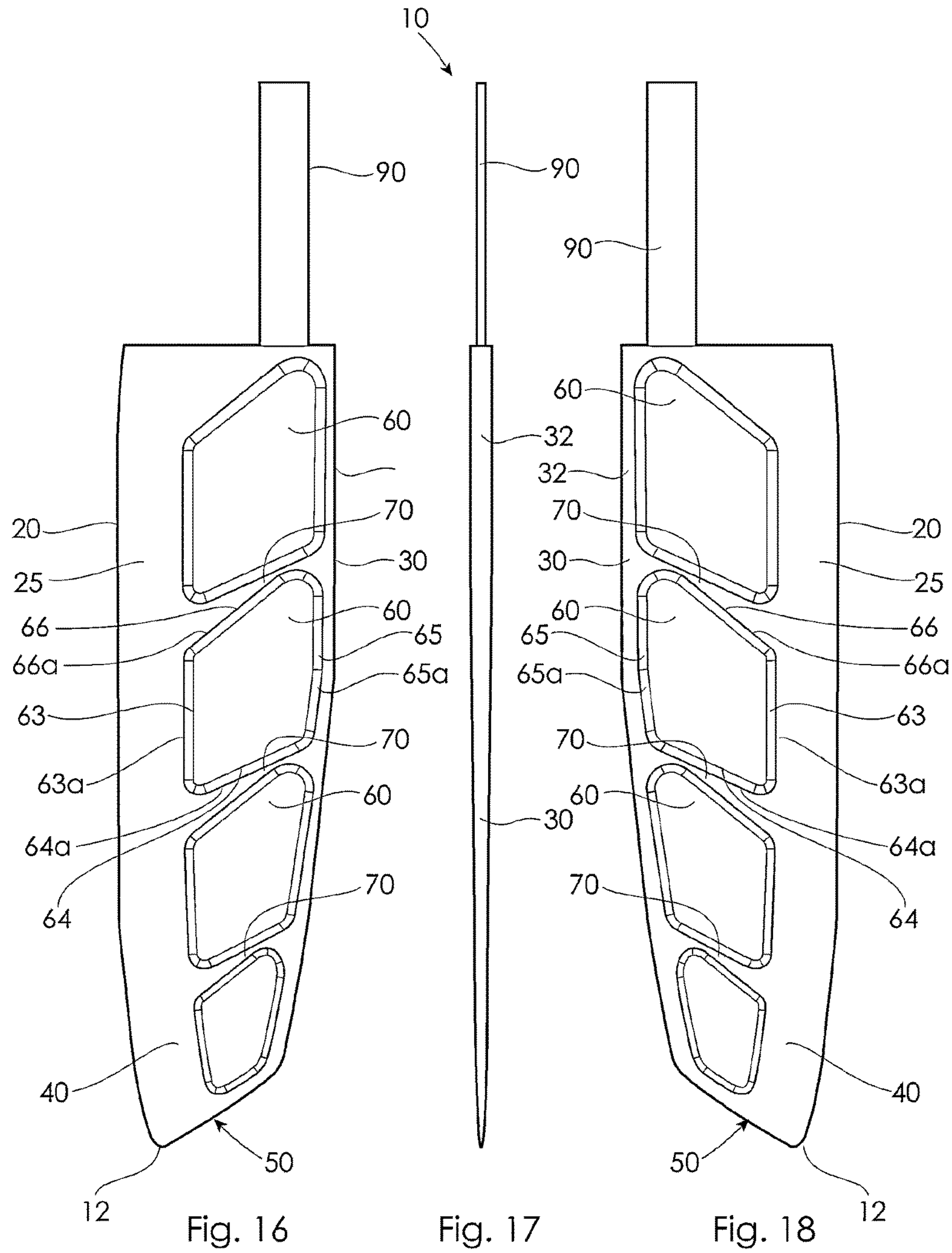
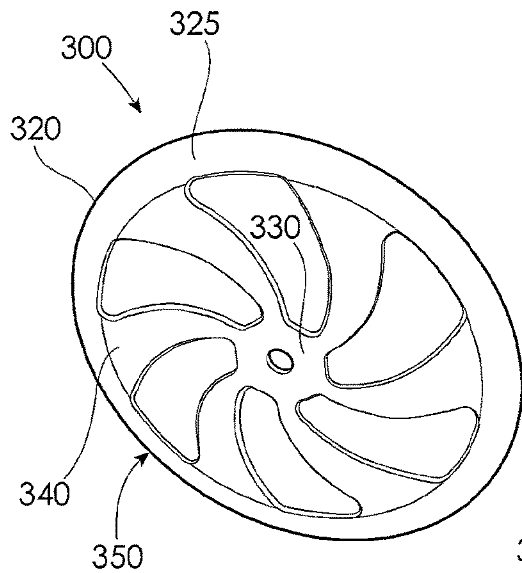


Fig. 16 Fig. 17 Fig. 18



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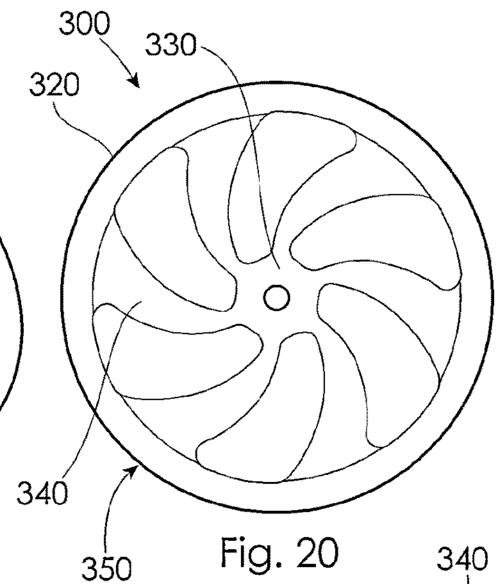

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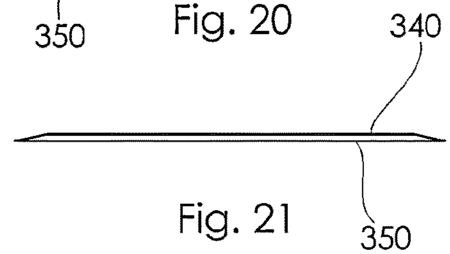

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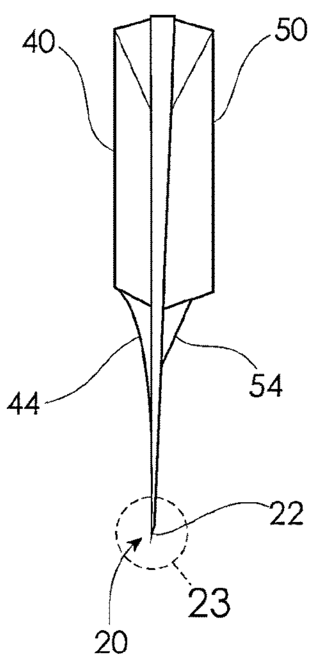

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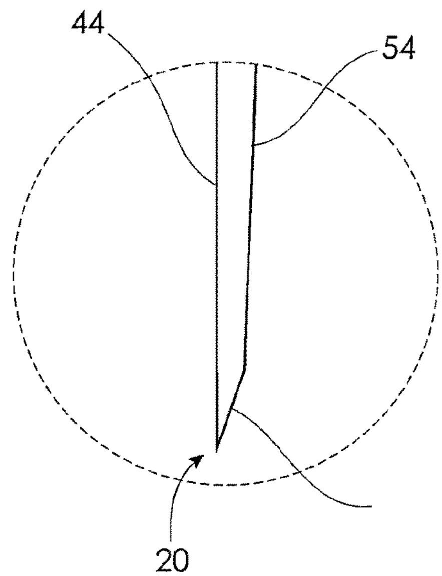

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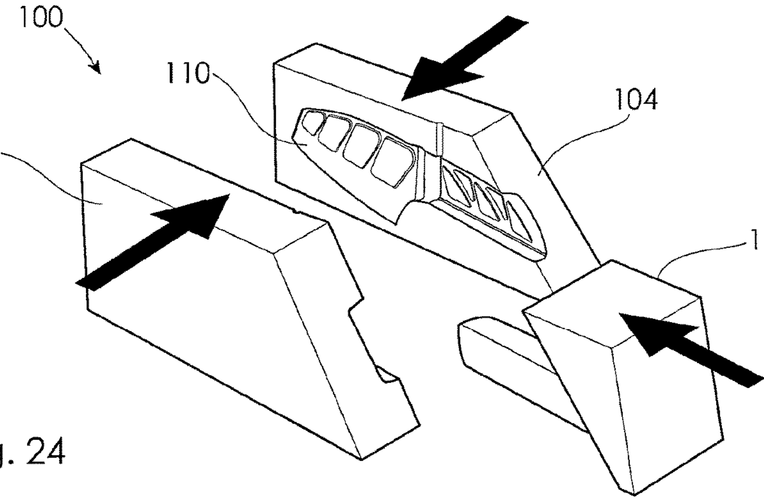

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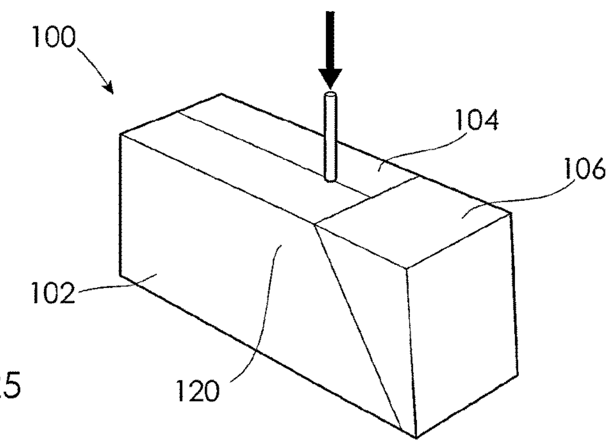

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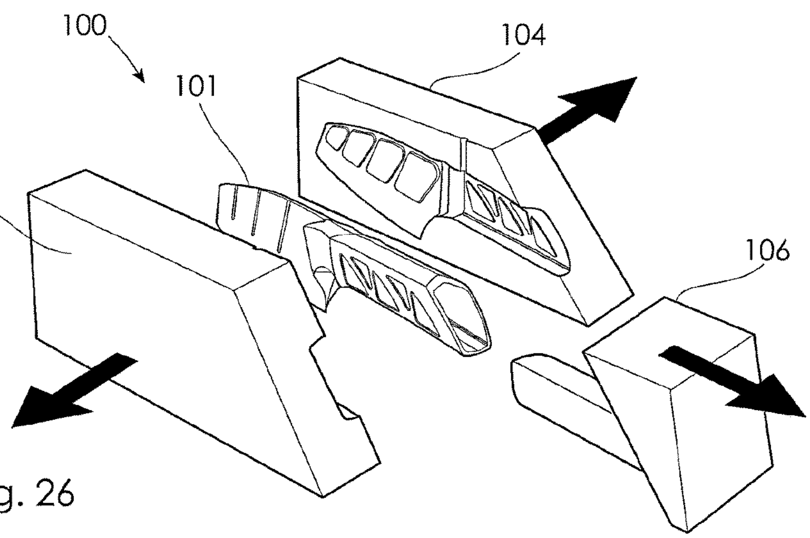

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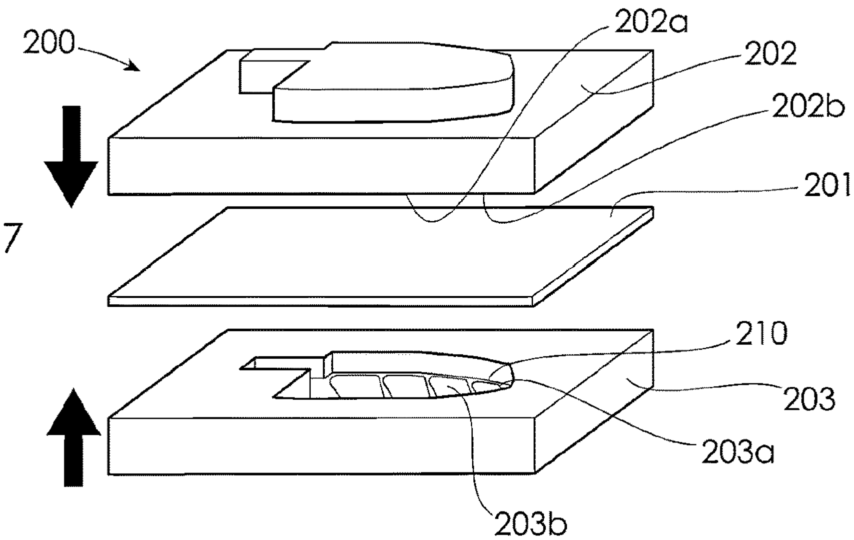

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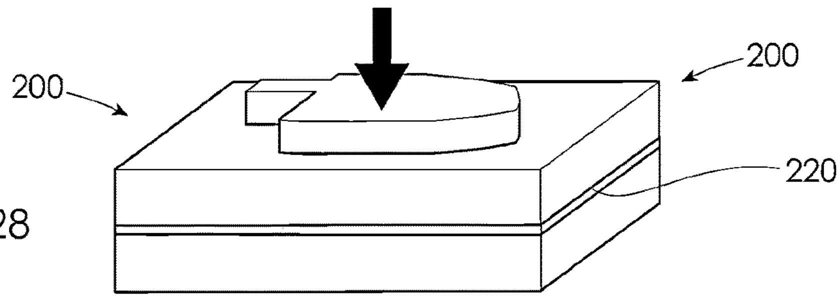

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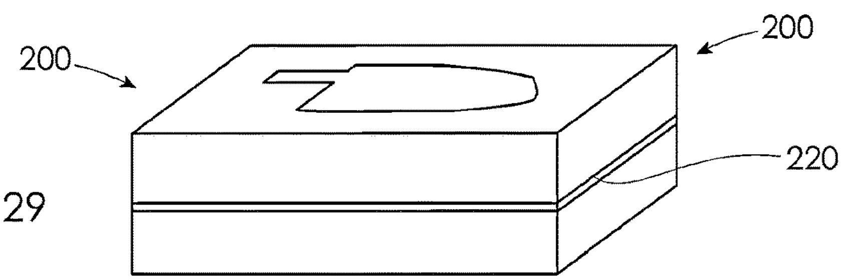

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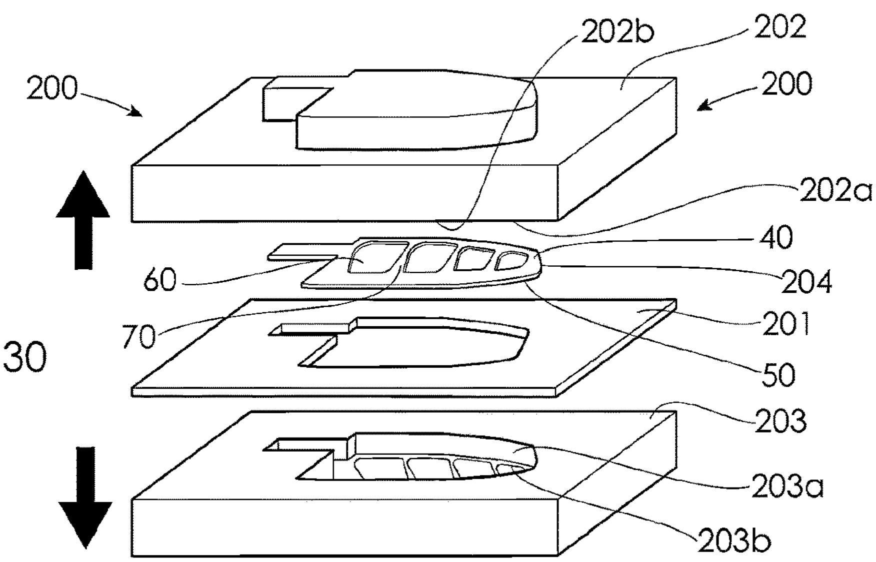

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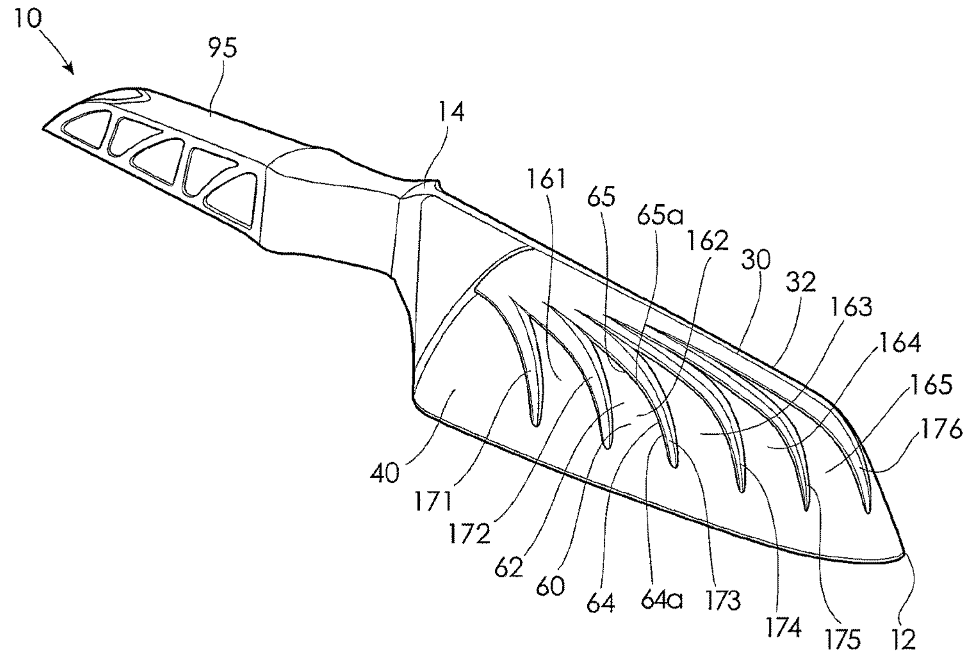
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Fig. 31

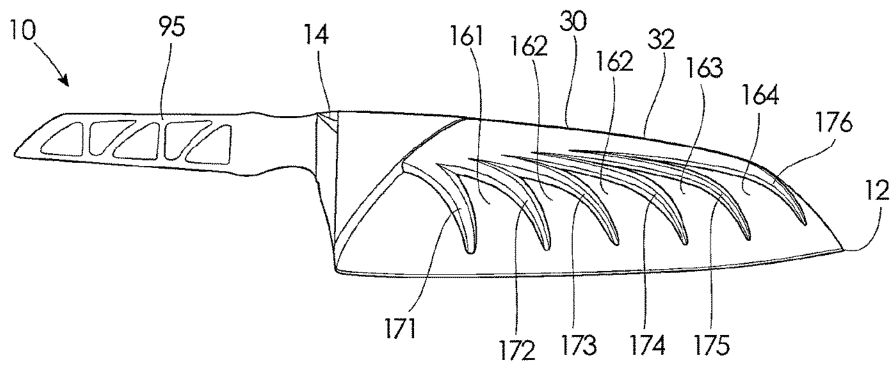
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Fig. 32

CUTTING BLADE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This Utility Patent Application is a U.S. National Stage filing under 35 U.S.C. § 371 of PCT/AU2015/000036, filed Jan. 22, 2015, which claims priority to U.S. Provisional Application No. 61/930,195, filed Jan. 22, 2014, incorporated by reference herein.

TECHNICAL FIELD

[0002] The present invention relates to blades for cutting and particularly although not exclusively to knife blades such as kitchen knives.

BACKGROUND OF INVENTION

[0003] Cutting blades such as kitchen knife blades, are typically formed by a process in which a knife blank is produced such as by forging or stamping a piece of metal into a shape that closely resembles the final form of the knife blade. The blank typically includes a knife blade comprising a spine and an opposite edge, which is subsequently sharpened to form a cutting edge, extending longitudinally from a bolster to a tip where, in the case of a chefs knife, the spine and the cutting edge meet. The blank typically includes a tang extending from the bolster in an opposite direction to the knife blade to which a plastic or wooden handle is attached by any suitable means such as with rivets or the like. Other knives include a handle that is formed of metal and is connected to the tang or to the bolster such as by a metal brazing, welding or other like process so as to produce a knife having the appearance of the blade and handle having been formed as a single integral component. As mentioned above, the edge of the blade opposite the spine is typically sharpened in a grinding process and the resulting blade, having a sharpened cutting edge, may be honed and polished to produce the final product.

[0004] Lower cost knife blades can include a narrow band of material along the cutting edge which is ground to produce a concave or "hollow grind" in which opposite sides of the ground cutting edge are formed with opposite concave ground bands (i.e. curved inwardly) that meet at the cutting edge. The concave ground cutting edge may be supplemented with a single or double bevel (i.e. V-shaped grind to form the cutting edge. Better quality kitchen knives typically have what is referred to as a "wedge grind" in which the blade has a continuous taper from the spine, which is the thickest part of the knife blade, to the cutting edge, which is the thinnest part of the knife blade. The "wedge grind", sometimes also referred to as the full flat grind, may include a secondary grind such as a single bevel or double bevel grind at the cutting edge. Manufacturing processes by which knife blades are typically produced are referred to as subtractive manufacturing techniques as the knife blank is stamped from a sheet of metal and further material is removed from the knife blank, such as by grinding, to form the final knife blade.

[0005] The purpose of the cutting edge of a knife blade is to engage an item, such as a food item, and to cut through the food item while the spine provides strength for the knife blade and support for the cutting edge. The side surfaces of the knife blade which extend from the cutting edge to the spine, sometimes also referred to as "cheeks" of the knife blade, occupy an intermediate portion of the knife blade between the cutting edge and the spine. A thickness of the knife blade, defined by the distance between opposite side surfaces of the knife blade, typically tapers from the spine to the cutting edge. In the case of a wedge grind knife blade, the knife blade has a substantially constant taper from the spine to the cutting edge.

[0006] Knife blades can be employed in a chopping action in which the cutting edge of the blade is forced directly through a food item or in a slicing action in which the knife blade is also moved in a back and/or forth motion while cutting through the food item. Resistance is experienced by a user when cutting through a food item with a knife blade. Such resistance can be particularly problematic in circumstances where a knife blade is to be used for long periods such as by professional cooks, butchers, chefs and the like. It has been found that resistance experienced by a user during cutting of a food item is primarily due to three main factors. One such factor is cutting edge resistance, which results from the cutting edge of the blade stressing the food material beyond its yield and tensile strength to thereby shear the food item at the cellular fibre level thereby initiating cutting of the food item. Cutting edge resistance can occur whether the blade is forced in a linear downward direction through the food item (i.e. chopping) or in a linear downward direction as well as with a back and forth motion of the knife blade (i.e. slicing). Another factor is blade "wedging" resistance, which results from the wedge angle of the side surfaces of the knife blade pushing the food apart as the knife blade penetrates through the food item. The harder the food item being cut by the knife blade the greater the "wedging" resistance that will be experienced during cutting. The third factor is blade surface resistance, which results from friction between the side surfaces of the knife blade and the food item as the cutting edge penetrates through the food item. This form of resistance can be the largest contributor to cutting resistance particularly if the food item is wet and/or sticky and has a relatively high coefficient of friction. Wet and sticky foods will tend to form a seal against the side surface of the knife blade thus creating a vacuum therebetween. This vacuum increases the surface resistance over and above that which is attributable to friction between the blade surface and the food item alone. The greater the surface area of the food item and the side surfaces of the blade that are in contact with each other, the greater the resulting friction therebetween.

[0007] Accordingly, a desirable outcome of the present invention is to provide a cutting blade that ameliorates the problems associated with existing cutting blades such as cutting resistance and resultant user fatigue.

SUMMARY OF INVENTION

[0008] Accordingly, in one aspect, the present invention provides a cutting blade comprising: a cutting edge, a spine and opposite side surfaces; a tapered portion of the blade immediately adjacent the cutting edge in which a thickness of the blade defined as a transverse distance between the opposite side surfaces tapers towards the cutting edge; one or more broad recesses provided in one or more side surfaces of the blade, wherein at least one of the broad recesses is bounded at vertically opposite sides by the tapered portion and the spine and at longitudinally opposite sides by narrow supporting elements extending from the spine to the tapered portion.

[0009] At least one of the recesses can have a base in which the thickness of the blade is, at least in part, substantially the same or thinner than a maximum thickness of the blade at an adjoining portion of the tapered portion and that, at least in part, is thinner than a thickness of the blade at an adjoining portion of the spine. Furthermore, at least one of the recesses can include a substantially planar base bounded by side surfaces upstanding from the base that adjoin the spine and the supporting elements, and in an embodiment also includes a side surface upstanding from the base that adjoins the tapered portion. In an embodiment, the base tapers substantially continuously with the adjoining portion of the tapered portion.

[0010] The sides of the recess preferably define a boundary of the recess along, at least in part, curved lines or substantially straight lines whereby, in the latter case, the boundary is substantially polygonal. Preferably, the boundary is defined, at least in part, along arcuate lines at which the substantially straight lines meet.

[0011] In embodiments of the cutting blade, both of the side surfaces of the blade include the broad recesses and the narrow supporting elements. Preferably, the broad recesses and the narrow supporting elements on one of the side surfaces are substantially symmetrical with the broad recesses and the narrow supporting elements on the other side surface. In yet a further preferred embodiment, the sides surfaces of the blade are substantially symmetrical with each other.

[0012] In embodiments, at least one of the recesses is shallowest immediately adjacent the tapered portion and is deepest immediately adjacent the spine. At least one of the recesses can become progressively deeper towards the spine. Preferably, the minimum thickness of the blade within any one of the recesses is up to 80% or 70% or 60% or 50% or 40% or 30% or 20% of the thickness of an adjoining portion of the spine. At least one of the broad recesses can have a vertical dimension that is greater than a vertical dimension of either an adjoining portion of the tapered portion or an adjoining portion of the spine. In embodiments, the broad recesses together occupy more than 10% or more than 20% or more than 30% or more than 40% or more than 50% or more than 60% or more than 70% or more than 80% of a total surface area of at least one of the side surfaces of the blade.

[0013] In embodiments of the cutting blade, at least one of the narrow supporting elements is an elongated rib. Preferably, at least one of the elongated ribs tapers from a wider portion adjacent the tapered portion of the blade to a narrower portion adjacent the spine of the blade. In another embodiment, at least one of the elongated ribs tapers from a wider portion adjacent the spine of the blade to a narrower portion adjacent the tapered portion of the blade. In further embodiments, the thickness of the blade at the narrow supporting elements becomes progressively thicker towards the spine of the blade. Preferably, at least one of the narrow supporting elements extends at an incline from the tapered zone to the spine. The incline is preferably between **45** and **90** degrees from the tapered zone to the spine and any increment therebetween.

[0014] In yet a further embodiment, the elongated supporting elements are in the form of a plurality of fingers extending from the spine towards the tapered portion immediately adjacent the cutting edge of the blade with the recesses defined in spaces between adjacent pairs of the elongated supporting elements.

[0015] In embodiments of the cutting blade, one of the side surfaces includes a plurality of channels extending from the tapered portion to the spine. At least one of the channels can have an open end at an edge of the blade adjoining the spine. In addition or in the alternative, the channels can meet a vent channel extending in a longitudinal direction of the knife blade.

[0016] The cutting blade, which is preferably a knife blade such as a kitchen knife (e.g. chefs knife, carving knife, boning knife, paring knife, cheese knife etc.) or a hunting or fishing knife, preferably includes a handle that is integrally formed with the cutting blade. Alternatively, the handle may be moulded over or fixed to a tang portion of the blade such as by rivets or the like.

[0017] In a preferred form, the handle includes a cavity comprising an opening for receiving one or more objects therewithin. Such objects may be other blade, sharpening or polishing or other accessories or the like. Preferably, the one or more objects includes one or more weights for adjusting a balance of the blade and the handle.

[0018] The tapered portion of the cutting blade preferably includes a pair of opposite concave surfaces meeting at the cutting edge. In embodiments, the cutting edge is an asymmetrical cutting edge. In further embodiments, the cutting edge is a single bevel cutting edge, however, the cutting edge may include a double bevel cutting edge.

[0019] In another aspect, the present invention provides a method of forming a cutting blade, the method including: forming a mould having an interior surface defining a mould cavity, wherein the interior surface is shaped to define an external surface of a cutting blade including a cutting edge, a spine and opposite side surfaces, a tapered portion of the blade extending longitudinally and immediately adjacent to the cutting edge in which a thickness of the blade defined as a transverse distance between the opposite side surfaces tapers towards the cutting edge and one or more broad recesses provided in one or more side surfaces of the blade, wherein at least one of the broad recesses is bounded at vertically opposite sides by the tapered portion and the spine and at longitudinally opposite sides by narrow supporting elements extending from the spine to the tapered portion; and placing metallic material in the mould cavity and applying pressure to form the metallic material into a cutting blade.

[0020] In an embodiment, the mould may be formed by a process including forming a temporary filler piece having an external surface shaped in the form of the external surface of the cutting blade, covering the filler piece with a ceramic material and causing the ceramic material to solidify to form the mould out of ceramic material, removing the filler piece from within the ceramic mould with heat to leave the internal mould cavity within a ceramic mould, and casting molten metal into shape of the internal mould cavity to form the knife blade.

[0021] In another embodiment, the method may include providing a die comprising die sections that when brought together form an interior mould cavity defined by an interior surface shaped in the form of the external surface of the cutting blade; injecting a mixture of particulate metallic material and a binder into the interior mould cavity under pressure to produce a form in the shape of a knife blade; separating the die sections and ejecting the form; and heating the form to remove the binder and to fuse the metallic material to form the knife blade.

[0022] In yet another embodiment, the method includes providing a die comprising die sections that when brought together form an interior mould cavity defined by an interior surface shaped in the form of the external surface of the cutting blade; and placing a metal blank between the die sections and bringing the dies sections together under pressure to form the metal blank into the shape of a knife blade.

[0023] In each of the aforementioned methods, the interior surface of the mould cavity is preferably shaped to complement the external shape of any one of the forms and embodiments of the knife blade disclosed above.

[0024] In another aspect, the present invention relates to a method of forming a cutting blade, the method including: producing a model of a cutting blade including a cutting edge, a spine and opposite side surfaces, a tapered portion of the blade immediately adjacent the cutting edge in which a thickness of the blade defined as a transverse distance between the opposite side surfaces tapers towards the cutting edge and one or more broad recesses provided in one or more side surfaces of the blade, wherein at least one of the broad recesses is bounded at vertically opposite sides by the tapered portion and the spine and at longitudinally opposite sides by narrow supporting elements extending from the spine to the tapered portion; generating geometric data corresponding to the shape and configuration of the cutting blade; providing a processor executing instructions stored on a computer readable non-transient storage medium produced from the geometric data for controlling a device for producing a three dimensional reproduction of the model represented by the geometric data using an additive process in which successive layers of metallic material are laid down thereby forming the cutting blade.

BRIEF DESCRIPTION OF DRAWINGS

[0025] The present invention will now be described with reference to the accompanying drawings, which illustrate particular preferred embodiments of aspects of the present invention, wherein

[0026] FIG. **1** illustrates a perspective view of a knife blade in accordance with a preferred embodiment of the invention illustrating, in particular, broad recesses and interposed supporting elements in one side surface of the blade;

[0027] FIG. **2** illustrates a perspective view of the knife blade of FIG. **1** illustrating, in particular, channels formed into a side surface of the blade opposite the side surface comprising the recesses and supporting elements;

[0028] FIGS. **3**, **4** and **5** illustrate side and top views of the knife blade of FIG. **1**;

[0029] FIG. **6** illustrates a perspective view of a knife blade in accordance with another preferred embodiment of the invention illustrating, in particular, broad recesses and interposed supporting elements in one side surface of the blade and a handle formed with the blade, wherein the handle has a hollow internal cavity;

[0030] FIG. **7** illustrates a perspective view of the knife blade of FIG. **6** illustrating, in particular, channels formed into a side surface of the blade opposite the side surface comprising the recesses and supporting elements;

[0031] FIGS. **8**, **9** and **10** illustrate side and top views of the knife blade of FIG. **6**;

[0032] FIG. **11** illustrates a perspective view of a knife blade in accordance with a preferred embodiment of the invention illustrating, in particular, broad recesses and interposed supporting elements in one side surface of the blade;

[0033] FIG. **12** illustrates a perspective view of a knife blade in accordance with another embodiment illustrating, in particular, broad recesses formed into both side surfaces of the blade and, for each broad recess, a corresponding protrusion formed on the other side surface of the blade;

[0034] FIG. **13** illustrates a perspective view of the knife blade of FIG. **12** after a subsequent step of grinding the sides surfaces is carried out to remove the protrusions;

[0035] FIGS. **14** and **15** respectively illustrate a top view of the blade of FIG. **12** before and after removal of the protrusions;

[0036] FIGS. **16**, **17** and **18** illustrate side, top reverse side views of the the knife blade of FIG. **11** illustrating the broad recesses and supporting elements in both side surfaces of the blade;

[0037] FIGS. **19**, **20** and **21** illustrate a perspective, top and side views of a rotary cutting blade in accordance with another aspect of the invention comprising a cutting edge and opposite side surfaces extending towards a central zone wherein the side surfaces comprise broad recesses interposed by supporting elements;

[0038] FIGS. **22** and **23** illustrate a transverse cross section of a tapered portion of the blade of FIGS. **1** to **10** in more detail.

[0039] FIGS. **24** to **26** illustrate an embodiment of the method of forming the cutting blade including a mould or die formed of a plurality of mould or die sections that are brought together to form a mould cavity which is employed in a metal injection moulding process to form the knife blade of FIGS. **6** to **10**;

[0040] FIGS. **27** to **30** illustrate an embodiment of the method of forming the cutting blade including a mould or die formed of a plurality of mould or die sections that are brought together to form a mould cavity in a metal pressing or stamping process to form the knife blades of FIGS. **11** to **18**;

[0041] FIGS. **30** and **31** illustrate perspective views of a knife blade in accordance with another preferred embodiment of the invention illustrating, in particular, broad recesses and interposed narrow supporting elements in both side surfaces of the blade, wherein the supporting elements resemble fingers extending from the spine towards the cutting edge of the blade and wherein a thickness between side surfaces of the blade tapers continuously from a tapered portion of the blade immediately adjacent the cutting edge and through a base of the recess to the spine.

DETAILED DESCRIPTION

[0042] The present invention generally relates to a cutting blade. Embodiments of the invention are illustrated in FIGS. **1** to **18**, **30** and **31** wherein like reference numerals are employed to identify like features. The embodiments of FIGS. **1** to **18**, **30** and **31** are in the form of chefs knife blades **10**. The knife blade **10** comprises a cutting edge **20**, a spine **30** and opposite side surfaces **40**, **50**. The knife blade **10** includes a tapered portion **25** extending longitudinally and immediately adjacent the cutting edge **20** in which the thickness of the blade **10**, defined as a transverse distance between the opposite side surfaces **40**, **50**, tapers towards the cutting edge **20**. One or more broad recesses **60** are provided in one or more side surfaces **40**, **50** of the blade **10**, wherein at least one of the broad recesses **60** is bounded at vertically opposite sides **63**, **65** by the tapered portion **25** and the spine **30** and at longitudinally opposite sides **64**, **66** by narrow supporting elements **70** extending from the spine **30** to the tapered portion **25**.

[0043] The terms "broad" and "narrow" as used herein, refer to relative dimensions of the recesses **60** and the supporting elements **70**, preferably in a longitudinal direction of the knife blade **10**. The broadness (i.e. the length or width dimension) of the broad recesses **60** in the longitudinal direction of the knife blade **10** is such as to preferably occupy a major proportion of the length of the blade **10** whilst the width dimension of the supporting elements **70** also in the longitudinal direction occupy a minor, and preferably as small as possible, proportion of the length of the blade **10**. As will become apparent from the disclosure contained in this specification, the broadness of the recesses **60** and the narrowness of the interposing supporting elements **70** results in the blade **10** exhibiting reduced cutting resistance. This is due, at least in part, to the blade **10** having a substantially reduced average wedge thickness which reduces cutting resistance to due to the wedging effect and by reducing the total surface area of the one or more sides surfaces **40**, **50** in contact with the food item which reduces cutting resistance due to friction between the side surfaces **40**, **50** of the blade **10** and the food item particularly in comparison to a comparable sized wedge shaped knife blade with planar side surfaces. It is to be appreciated that the present invention may be applied to other forms of kitchen knives such as carving, paring, boning, cheese knives to name but a few. The invention may be applied to other knives not for use in the kitchen such as hunting and fishing knives.

[0044] Referring to the embodiments of FIGS. **1** to **18**, **30** and **31**, the knife blade **10** further includes a tip **12** at which the cutting edge **20** and the spine **30** meet and a bolster **14** at an opposite end of the knife blade **10**. The cutting edge **20** of the knife blade **10** is operable for engaging and cutting though a food item and the spine **30** provides strength and support for the blade **10** and for the cutting edge **20**. An intermediate portion **15** between the cutting edge **20** and the spine **30** transmits forces from the cutting edge **20** and the tapered portion **25** immediately adjacent the cutting edge to the spine **30**. However, unlike existing wedge shaped knives with planar side surfaces, the broad recesses **60**, which are provided in at least one of the side surfaces **40**, **50** of the cutting blade **10**, results in the blade **10** having a relatively shallow thickness (i.e. reduced volume) throughout a relatively large and preferably a major proportion of the intermediate portion **15** of the blade **10** between the tapered portion **25** immediately adjacent the cutting edge **20** and the spine **30**. The relatively shallow thickness of the blade **10** between the tapered portion **25** and the spine **30** results in a substantially reduced average wedge thickness of the knife blade **10** which reduces cutting resistance due to the wedging effect.

[0045] In the embodiments of FIGS. **1** to **18**, at least one of the recesses **60** has a base **62** that is preferably substantially planar and is bounded by respective side surfaces **63***a*, **65***a*, **64***a*, **66***a* upstanding from the base **62**. The side surfaces **63***a*, **65***a*, **64***a*, **66***a* adjoin the tapered portion **25**, the spine **30** and a pair of the supporting elements **70** of the blade **10** along the sides **63**, **65**, **64**, **66** of the recess **60**. In particular, a vertically opposite pair of the side surfaces **63***a*, **65***a* respectively adjoin the tapered portion **25** and the spine **30** of the blade **10** along the sides **63**, **65**. One or both of a longitudinally opposite pair of the side surfaces **64***a*, **66***a* adjoin a pair of the supporting elements **70** along the sides **64**, **66**, wherein the pair of supporting elements **70** are spaced apart from each other in the longitudinal direction of the blade **10**. The sides **63**, **65**, **64**, **66** and the side surfaces **63***a*, **65***a*, **64***a*, **66***a* of at least one, and preferably all of the recesses **60**, are defined, at least in part, along substantially straight lines whereby a boundary **61** of the recess **60** is substantially polygonal. Furthermore, the boundary **61** is defined, at least in part, along arcuate lines **63***b*, **65***b*, **64***b*, **66***b*, preferably where arcuate side wall portions adjoin the substantially straight side surfaces **63***a*, **65***a*, **64***a*, **66***a*. Thus, the surface area of the side surfaces **40**, **50** occupied by the recesses **60** is maximised and the surface area occupied by the supporting elements **70** is minimised.

[0046] In the embodiments of FIGS. **31** and **32**, at least one of the recesses **60** has a base **62** that is preferably substantially planar and is bounded by the tapered portion and the spine **30** at the vertically opposite sides **63**, **65** of the recess **60** and by a pair of the narrow supporting elements **70** at the longitudinally opposite sides **64**, **66** of the recess **60**. The recess **60** includes side surfaces **65***a*, **64***a*, **66***a* upstanding from the base **62** that adjoin the spine **30** and the pair of the supporting elements **70**. Thus, a longitudinally opposite pair of the side surfaces **64***a*, **66***a* adjoin a pair of the supporting elements **70** along the longitudinally opposite sides **64**, **66** wherein the pair of supporting elements **70** are spaced apart from each other in the longitudinal direction of the blade **10**. However, in contrast to the embodiments of FIGS. **1** to **18**, in the blade **10** embodiment of FIGS. **30** and **31**, the base **62** of the recess **60** seamlessly adjoins the tapered portion **25** of the blade **10** along the remaining lower side **63** of the recess **60**. Thus, in this embodiment, the base **62** tapers substantially continuously with the adjoining portion of the tapered portion **25**. The sides **65**, **64**, **66** and the side surfaces **65***a*, **64***a*, **66***a* of at least one, and preferably all of the recesses **60**, are defined, at least in part, along substantially curved lines. One of the longitudinally opposite side surfaces **64***a* along one of the sides **64** seamlessly merges into the side surface **65***a* at along the side **65** adjoining the spine **30** in a continuous curve.

[0047] In the embodiments of FIGS. **1** to **18**, **30** and **31** the narrow supporting elements **70** provide support for the tapered portion **25** and the cutting edge **20** by transmitting forces from the cutting edge **20** to the spine **30**. The supporting elements **70** and in particular an outwardly facing surface **71** thereof, which is spaced apart from the base **62** of an adjacent recess **60**, contacts a food item being cut as the cutting edge **20** penetrates through the food item and maintains the food item out of contact with at least part of the base **62** of the broad recess **60**. As the supporting elements **70**, and the outwardly facing surface **71** thereof, are narrow a total surface area of the one of more of the side surfaces **40**, **50** comprising the broad recesses **60** and the supporting elements **70** that is in contact with the food item being cut is relatively small. Thus, cutting resistance due to friction between the side surfaces **40**, **50** of the blade **10** and the food item is reduced as the total surface area of the one or more sides surfaces **40**, **50** comprising the recesses **60** in contact with the food item is less than that of a comparable wedge shaped knife blade with planar side surfaces. Furthermore, the recesses **60** reduce the propensity for a vacuum to be established between the one or more sides surfaces **40**, **50** comprising the recesses **60** in contact with the food item is less than that of a comparable wedge shaped knife blade with planar side surfaces.

[0048] At least one of the narrow supporting elements **70** and as illustrated in the embodiments of FIGS. **1** to **18**, **30** and **31** preferably all of the supporting elements **70** are in the form of elongated ribs **72**. At least one, preferably all, of the elongated ribs **72** taper from a wider portion **74** adjacent the tapered portion **25** of the blade **10** to a narrower portion **76** adjacent the spine **30** of the blade **10**. Within the narrow supporting elements **70**, the blade **10** is thinnest at the wider portion **74** adjacent the tapered portion **25** and becomes progressively thicker towards the narrower portion **76** adjacent the spine **30** of the blade **10**. Furthermore, at least one and preferably all of the narrow supporting elements **70** extend at an incline from the tapered zone **25** to the spine **30**. The angle of incline of the supporting elements **70** is preferably optimised for the purpose for which the knife blade **10** is designed, for example a chefs knife which is typically employed for downward and forward cutting motions may have supporting elements **70** that extend at an angle downwardly and forwardly from the spine **30**. In contrast, a form of the knife blade **10** used for slicing sashimi or for carving which may typically be used to cut food items in a pulling motion may have supporting elements **70** that extend at an angle downwardly and rearwardly from the spine **30**. The angle of incline of the supporting elements **70** is preferably between **45** and **90** degrees from the tapered zone **25** to the spine **30**. In the embodiment of FIGS. **31** and **32**, the narrow supporting elements **70** form a plurality of fingers **171**, **172**, **173**, **174**, **175**, **176** extending from the spine **30** towards the tapered portion **25** immediately adjacent the cutting edge **20** of the blade **10** with recesses **161**, **162**, **163**, **164**, **165** defined in spaces between adjacent pairs of the fingers **171**, **172**, **173**, **174**, **175**, **176**. In each of the embodiments of FIGS. **1** to **18**, **30** and **31**, the external surface **71** of each of the narrow supporting elements **70** is convex in transverse cross section. In each embodiment the external surface **71** can be outwardly curved in transverse cross section as represented in the embodiment of FIGS. **30** and **31**.

[0049] It is to be appreciated that the shape and configuration of the blade **10**, the spine **30**, the recesses **60** and the intervening supporting elements **70** can be optimised, such as by finite element analysis or any computer aided design technique, so as to maximise the surface area of the side surfaces **40**, **50** occupied by the recesses **60** and to minimise the surface area occupied by the supporting elements **70** (i.e. the surface area of the outward facing surfaces **71**) whilst providing sufficient strength (e.g. rigidity) to the blade **10** and support to the cutting edge **20** and the adjacent tapered portion **25** of the blade **25**. Furthermore, this optimisation process can be carried out separately for each knife blade type (e.g. chefs knife, carving knife, paring knife, boning knife, cheese knife, hunting or fishing knife etc.). Thus, each different form of the knife blade **10**, depending on the duties to be carried out by the knife blade **10** and the characteristics of the materials used to form the knife blade **10**, can have a different configuration particularly with respect to the dimensions, quantity, shapes and configurations of the broad recesses **60** and the supporting elements **70**.

[0050] Referring to the embodiments illustrated in FIGS. **1** to **18**, the thickness of the blade **10** within the base **62** of any one of the recesses **60** is the same or thinner than a maximum thickness of the blade **10** at an adjoining portion of the tapered portion **25**. In the case of the embodiment of FIGS. **30** and **31**, the thickness of the blade **10** within the base **62** of any one of the recesses **60** is, at least in part, substantially the same than a maximum thickness of the blade **10** at an adjoining portion of the tapered portion **25** and becomes progressively thicker towards the spine **30**. Nevertheless, in each embodiment the thickness of the blade **10** within the base **62** of any one of the recesses **60**, at least in part and preferably in whole, is thinner than a thickness of the blade **10** at an adjoining portion of the spine **30**. In the embodiments illustrated in the Figures, the base **62** of each one of the recesses **60** is shallowest immediately adjacent the tapered portion **25** and is deepest immediately adjacent the spine **30**. Furthermore, the base **62** of each one of the recesses **60** becomes progressively deeper towards the spine **30**. Preferably, the minimum thickness of the blade within any one of the recesses **60** is up to 80% or 70% or 60% or 50% or 40% or 30% or 20% of the thickness of an adjoining portion of the spine **30**.

[0051] In the embodiments of FIGS. **1** to **18**, **30** and **31**, the broad recesses **60** each have a vertical dimension, which is a dimension that is at substantially **90** degrees to a longitudinal direction of the knife blade **10**, that is greater than a vertical dimension of either an adjoining portion of the tapered portion **25** or an adjoining portion of the spine **30**. In these and other non-illustrated embodiments, the broad recesses **60** together occupy more than 10% or more than 20% or more than 30% or more than 40% or more than 50% or more than 60% or more than 70% or more than 80% of a total surface area of at least one of the side surfaces **40**, **50** of the blade **10** or any increment therebetween.

[0052] As can be seen in the embodiments illustrated in FIGS. **2**, **4**, **5**, **7**, **9** and **10**, one of the side surfaces **40**, **50** includes a plurality of channels **80** extending from the tapered portion **25** to the spine **30**. At least one of the channels **80** has an open end **82** at an edge **32** of the blade **10** adjoining the spine **30**. In another embodiment, the channels **80** meet at a vent channel (not shown) extending in a longitudinal direction of the knife blade **10**. The vent channel includes an open end located towards the bolster **14** of the blade **10**. The open ends **82** of the channels **80** of the former embodiment and the open end of the vent channel of the latter embodiment allow for the ingress and egress of air to the channels **80** and the vent channel to reduce propensity for a vacuum to form between the food item and the side surface **40**, **50** of the blade comprising the channels **80**, thereby reducing resistance experienced during cutting of food items with the blade **10**.

[0053] In the embodiment of the knife blade **10** of FIGS. **11** to **18**, the broad recesses **60** are provided in both sides **40**, **50** of the blade **10** and are separated from each other or interposed by the narrow supporting elements **70**. Although not illustrated in FIGS. **11** to **18**, a vent channel may be provided within each of the narrow supporting elements. In FIGS. **11**, **16**, **17** and **18**, the broad recesses **60** and the narrow supporting elements **70** on one of the side surfaces **40** are substantially symmetrical with the broad recesses **60** and the narrow supporting elements **70** on the other side surface **50**. Furthermore, the side surfaces **40**, **50** of the blade **10** are substantially symmetrical with each other. In FIGS. **13** and **15**, the broad recesses **60** alternate along the blade **10** between the side surfaces **40**, **50**. During production of the blade **10** embodiment of FIGS. **12** to **15**, such as by a metal pressing/stamping process described below, a broad recess **60** is formed on one of the sides surfaces **40**, **50** with a complementary shaped protrusion **70***a* formed on the other side surface **40**, **50**. The protrusions **70***a* on one or both of the side surfaces **40**, **50** are removed by grinding to finish the knife blade **10**. The narrow supporting elements **70** are formed between adjacent pairs of the broad recesses **60** which are on opposite sides **40**, **50** of the blade **10**. The embodiments of FIGS. **11** to **18** are advantageous in that the provision of broad recesses **60** on both sides surfaces **40**, **50** of the blade **10**, and in some embodiments such as in FIGS. **11** and **16** to **18**, with supporting elements **70** with narrow outwardly facing surfaces **71**, means that the blade **10** can be used by a left or right handed user and still provide the same advantageous benefits of reducing cutting resistance due to the reduction of wedging resistance and blade surface resistance.

[0054] FIGS. **1** to **5** and **11** to **18** illustrate a knife blade **10** comprising a tang **90** over which a handle made of metal, wood, plastic or the like may be formed. The embodiments of the knife blade **10** illustrated in FIGS. **6** to **10**, **30** and **31** include a handle **95** integrally formed with the knife blade **10**. Referring to the knife blade **10** of FIGS. **6** to **10**, **30** and **31**, the handle **95** is formed integrally with the knife blade **10** and includes a cavity **96** that extends longitudinally through the handle **95** from an open end **97** to a closed end **98**. The open end **97** may be selectively closable such as by a stopper, cap or the like (not shown) which may be held in place within the cavity **96** at the open end **97** by an interference fit, or by a threaded coupling or any other suitable means. The cavity **96** is operable for receiving and containing one or more objects therewithin such as smaller knife blades, sharpening and/or honing and/or polishing devices. The cavity **96** may also be operable for receiving and containing one or more weights at any one or more locations along the length of the handle for altering and customising the balance of the combination knife blade **10** and handle **95**. The weights may be removable or once installed may be fixed and not intended for removal.

[0055] FIGS. **22** and **23** illustrate a transverse cross section of the tapered portion **25** of the blade **10** in more detail. The opposite side surfaces **40**, **50** of the knife blade **10** at the tapered portion **25** converge towards each other to provide a tapering transverse thickness of the blade **10** towards the cutting edge **20**. In the embodiment illustrated in FIGS. **22** and **23**, a cutting edge zone **26** of the tapered portion **25** immediately adjacent the cutting edge **20** is comprised of opposite concave surfaces **44**, **54** which taper towards the cutting edge **20** in a manner in which the thickness of the blade **10** gradually decreases towards the cutting edge **20**. At the cutting edge **20** the blade **10** includes a single bevel **22**, which is preferably provided by a grinding process as part of a post finishing step in the production of the knife blade **10**. Thus, in the embodiment illustrated in FIGS. **22** and **23**, the concave surfaces **44**, **54** are asymmetrical and with the provision of a single bevel **22** cutting edge **20**, results in the blade having a minimal thickness immediately adjacent the cutting edge **20** to thereby minimise resistance to cutting associated with the wedge thickness of the blade **10** in the region of the cutting edge **10**. Furthermore, the sides surfaces **40**, **50** of the blade **10** approaching the cutting edge **20** are substantially parallel and close together to define a relatively thin portion of the blade **10**. Thus, as the blade **10** is worn away after numerous instances of sharpening the bevel **22** does not become substantially thicker than its original thickness thus extending the useable life of the blade **10**. In another embodiment (not shown), the cutting edge **20** of the blade **10** may be formed with a double bevel (i.e. a V-shaped cutting edge).

[0056] FIGS. **19** to **21** illustrate another aspect of the invention in the form of a rotary cutting blade **300**. The rotary cutting blade **300** includes a circular cutting edge **320** and opposite disc shaped side surfaces **340**, **350**, a tapered portion **325** of the blade immediately adjacent the cutting edge **320** in which a thickness of the blade defined as a transverse distance between the opposite side surfaces **340**, **350** tapers towards the cutting edge **320**. The rotary cutting blade **300** includes one or more broad recesses **360** provided in at least one and preferably both side surfaces **340**, **350** of the blade **300**. The broad recesses **360** are bounded at opposite sides **363**, **365** by the tapered portion **325** and by a central hub **330** and at transversely opposite sides **364**, **366** by narrow supporting elements extending from the hub **330** to the tapered portion **325**. The broad recesses **360** separated by narrow supporting elements **370** provide the rotary cutting blade **300** with similar advantages in terms of reducing cutting resistance to those exhibited by embodiments of the knife blade **10** described above.

[0057] In another aspect, the present invention involves a method or methods of forming a cutting blade, in particular a knife blade. Some methods comprise near-net manufacturing methods, such as additive manufacturing methods. However, some methods used to form certain knife blade embodiments include subtractive manufacturing techniques. In a broad sense, and with reference to the embodiments of FIGS. **24** to **30**, the method can include a step of forming a mould or die **100**, **200** having an interior surface **110**, **210** defining a mould cavity **120**, **220**, wherein the interior surface **110**, **210** is shaped to define an external surface of a cutting blade **10** in accordance with any of the embodiments described above and illustrated in the Figures. Thus, the interior surface **110**, **210** of the mould **100**, **200** is shaped to form the cutting blade **10** including the cutting edge **20**, the spine **30**, the opposite side surfaces **40**, **50** and the tapered portion **25** of the blade **10** immediately adjacent the cutting edge **20** in which the thickness of the blade **10** defined as a transverse distance between the opposite side surfaces **40**, **50** tapers towards the cutting edge **20**. Furthermore, the interior surface **110**, **210** of the mould **100**, **200** is shaped to form the cutting blade **10** with one or more of the broad recesses **60** provided in one or more of the side surfaces **40**, **50** of the blade **10**, wherein at least one of the broad recesses **60** is bounded at vertically opposite edges by the tapered portion **25** and the spine **30** and at longitudinally opposite side edges by the narrow supporting elements **70** extending from the spine **30** to the tapered portion **25**. The method also includes a step of placing metallic material in the mould cavity **120**, **220** and applying pressure to form the metallic material into a cutting blade **10**, **201**. Embodiments of the method include additive or near net manufacturing methods, described below, that enable knife blades with relatively complex forms to be produced such as the blade embodiments of FIGS. **1** to **10**, **30** and **31**. Other embodiments of the method include more traditional subtractive manufacturing methods such as metal pressing and grinding to produce the knife blade embodiments of FIGS. **11** to **18**.

[0058] FIGS. **24** to **26** illustrate an embodiment of the method in the form of a metal injection moulding (MIM) method in which metal injection moulding feedstock is produced from a mixture of fine metal powder (i.e. particulate) and one or more binders such as parrifin and a secondary thermoplastic polymer. A metal injection moulding machine includes the mould **100** which is comprised of mould or die sections **102**, **104**, **106** as illustrated in FIG. **24**. The mould sections **102**, **104**, **106** are brought together by the machine as illustrated in FIG. **25** to form the mould cavity **120**. The mixture is fed into the mould cavity under heat and pressure to form a part **101**, which is referred to as "green", which is then ejected from the cavity **120** as illustrated in FIG. **26**. The "green" parts **101** are submerged into a solvent to remove the primary binder. After removal of the primary binder the parts **101** are referred to as "brown" parts. The brown parts are then placed in a kiln or furnace to remove the remaining binder. Once the binder is removed, the particles of the metal fuse together and the component transforms to its final state, thus enabling knife blade with relatively complex forms to be produced such as the blade embodiments of FIGS. **1** to **10**, **30** and **31**.

[0059] Another near net manufacturing process, not illustrated in the Figures, includes investment casting. Investment casting involves producing a wax or plastic pattern substantially corresponding to the shape of the cutting blade **10** such as by a moulding process or the like. The wax patterns are then attached to a sprue. The sprue with attached wax patterns, undergoes the investment process in which a ceramic mould, known as the investment, is produced by repeating steps of coating stuccoing and hardening. The first step involves dipping the cluster into a slurry of fine refractory material and removing any excess so a uniform surface is produced. The fine material is used first to give a smooth surface finish and reproduce fine details. In the second step, the cluster is stuccoed with a course ceramic particle, by dipping it into a fluidised bed and placing it in a rainfall sander or applying it by hand. Finally the coating is allowed to harden. These steps are repeated until the investment is the required thickness, usually 5 to 15 mm thick. The investment is allowed to completely dry and is then placed in a furnace to melt out or vaporise the wax. The mould may be subjected to an additional heating process to remove any moisture and residual wax and sinter the mould. Metal may then be gravity poured or vacuum or tilt cast or the like into the moulds via the sprue. The final step is referred to as divesting in which the mould shell is removed to release the casting to reveal the cast cutting blades **10**. The aforementioned investment casting method enables knife blades with relatively complex forms to be produced such as the blade embodiments of FIGS. **1** to **10**, **30** and **31**.

[0060] FIGS. **27** to **30** illustrate an embodiment of the method comprising a metal press apparatus including a mould or die **200** which is comprised of mould or die sections **202**, **204** as illustrated in FIGS. **27** to **30**. The mould/die sections **202**, **204** are brought together in a hydraulic, mechanical or pneumatic press machine as illustrated in FIG. **28** to form the mould cavity **220**. Prior to bringing together the mould/die section **202**, **204**, a metal blank **201** is placed between the mould sections **202**, **204** which are brought together to stamp/compress the blank **201** into the shape of the cutting blade **204** illustrated in FIG. **30**. The mould/die sections **202**, **203** each have a respective interior surface **202***a*, **203***a*, that when brought together define the mould cavity **220**. The interior surface **202***a*, **203***b* of each mould/die section **202**, **203** is shaped to define the external surface of the cutting blade **10** in accordance with any of the embodiments described above and illustrated in the Figures. Thus, the interior surface **202***a*, **203***a* of each of the mould/die sections **202**, **203** is shaped to form the cutting blade **10** including the cutting edge **20**, the spine **30**, the opposite side surfaces **40**, **50** and the tapered portion **25** of the blade **10** immediately adjacent the cutting edge **20**. Furthermore, the interior surface **202***a*, **203***a* of each of the mould sections **202**, **203** is shaped to form the cutting blade **10** with the broad recesses **60** and the interposing narrow supporting elements **70** in one or both side surfaces **40**, **50** of the blade **10** as in the embodiment illustrated in FIGS. **11** and **16** to **18**. FIGS. **27** and **30** illustrate the interior surface **203***a* of a lower one of the mould sections **203** including surface features **203***b* that are shaped complementarily to the shape of one of the side surfaces **40**, **50** of the knife blade **10** including, in particular, the broad recesses **60** and narrow supporting elements **70**. Similarly, the interior surface **202***a* of the upper one of the mould sections **202** includes similar surface features (not shown) that are shaped complementarily to the shape of the other one of the side surfaces **40**, **50** of the knife blade **10** including, in particular, the broad recesses **60** and narrow supporting elements **70**. In the method of FIGS. **25** to **28**, the metal blank **201** is pressed by the mould sections **202**, **203** into the final form of the knife blade **10**, such as the embodiment illustrated in FIGS. **11** and **16** to **18**, with the broad recesses **60** and narrow supporting elements **70** in both side surfaces **40**, **50** of the blade **10**. The resulting knife blade **10** is formed with the tang **90** to which the handle **95**, which may or may not be a hollow handle capable of receiving objects such as weights, may be fixed in a subsequent step. Furthermore, the cutting edge **20** is sharpened in a final finishing step to include a single bevel or double bevel cutting edge.

[0061] In an alternative form of the method of FIGS. **27** to **30** the interior surface **202***a* of only one of the mould sections **202** is shaped to define the external surface of the cutting blade **10** with the broad recesses **60** and narrow supporting elements **70**. The interior surface **203***a* of the other one of the mould sections **203** is shaped, such as with appropriately shaped recesses and, possibly protrusions, (not shown) that are shaped to allow the first one of the mould sections **202** to form the broad recesses and narrow supporting elements **70** on one side **40** of the blade **10** and blade material to project from the other side **50** of the blade **10** as in the embodiments of FIGS. **1** to **10**. The protruding blade material formed on the other side of the blade can then be removed in a subsequent grinding step to produce the finished blade. In a variation of this method, the interior surfaces of the mould sections **202**, **203** are shaped to define the external surface of the cutting blade **10** with the broad recesses **60** on both side surfaces **40**, **50** of the blade **10**, wherein for each recess **60** formed on one of the sides surfaces **40**, **50** there is a corresponding protrusion **60***a* formed on the other side surface **40**, **50** of the blade **10**. Preferably, the recesses **60** and the protrusions **60***a* alternate, as in the blade **10** illustrated in FIGS. **12** and **14**, such that in a subsequent grinding step, the protrusions **60***a* on both side surfaces **40**, **50** of the blade **10** are ground away to leave broad recesses **60** on both sides surfaces **40**, **50** of the blade separated by narrow supporting elements **70** within which the blade **10** has a greater thickness than the recesses **60** adjacent to each supporting element **70** and on either side **40**, **50** of the blade **10**.

[0062] Another near net manufacturing process that can be employed, that is not illustrated in the Figures, includes 3D printing. Various forms of 3D printing methods exist that could be employed in the present invention. 3D printing methods that could be employed include fused deposition modelling (FDM), electron beam freeform fabrication (EBF), direct metal laser sintering (DMLS), electron-beam melting (EBM), selective laser melting (SLM), selective laser sintering (SLS). In 3D printing processes, 3D printable models are created with a computer aided design (CAD) package in which geometric data is provided to the 3D printing apparatus. The 3D printing apparatus includes a computer processor that executed instructions produced from the geometric data to control an apparatus for reproducing the model represented by the geometric data in a layer by layer fashion until the final product is produced. The aforementioned 3D printing method enables knife blades with relatively complex forms to be produced such as the blade embodiments of FIGS. **1** to **10**, **30** and **31**.

[0063] In the abovementioned near net manufacturing processes minimal finishing is required to produce the finished knife blade. Preferably, the only finishing process required is grinding of the cutting edge **20** and forming the bevel **22**. In the abovementioned embodiments that are illustrated with respect to the blade **10** of FIGS. **12** to **15**, a final grinding step is employed to remove the protrusions **60***a* as well as to grind the cutting edge **20**.

[0064] Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described. It is to be understood that the invention includes all such variations and modifications which fall within the spirit and scope of the present invention.

[0065] Where the terms "comprise", "comprises", "comprised" or "comprising" are used in this specification (including the claims) they are to be interpreted as specifying the presence of the stated features, integers, steps or components, but not precluding the presence of one or more other feature, integer, step, component or group thereof

[0066] Future patent applications may be filed in Australia or overseas on the basis of or claiming priority from the present application. Features may be added to or omitted from the following claims at a later date so as to further define or re-define the invention or inventions.

1. A cutting blade comprising:

a cutting edge, a spine and opposite side surfaces,

a tapered portion of the blade extending longitudinally and adjacent to the cutting edge in which a thickness of the blade defined as a transverse distance between the opposite side surfaces tapers towards the cutting edge;

one or more broad recesses provided in one or more side surfaces of the blade, wherein at least one of the broad recesses is bounded at vertically opposite sides by the tapered portion and the spine and at longitudinally opposite sides by narrow supporting elements extending from the spine to the tapered portion.

2. The cutting blade of claim **1**, wherein at least one of the recesses has a base in which the thickness of the blade is, at least in part, substantially the same or thinner than a maximum thickness of the blade at an adjoining portion of the tapered portion and that, at least in part, is thinner than a thickness of the blade at an adjoining portion of the spine.

3. The cutting blade of claim **2**, wherein the base tapers substantially continuously with the adjoining portion of the tapered portion.

4. The cutting blade of claim **1**, wherein at least one of the recesses includes a substantially planar base bounded by side surfaces upstanding from the base that adjoin the spine and the supporting elements.

5. The cutting blade of claim **4**, wherein at least one of the recesses further includes a side surface upstanding from the base that adjoins the tapered portion.

6. The cutting blade of claim **4**, wherein the sides define, at least in part, a boundary of the recess along, at least in part, substantially straight lines whereby the boundary is substantially polygonal.

7. The cutting blade of claim **6**, wherein the boundary is defined, at least in part, along arcuate lines at which the substantially straight lines meet.

8. The cutting blade of claim **4**, wherein the sides define, at least in part, a boundary of the recess along, at least in part, curved lines.

9. The cutting blade of claim **1**, wherein at least one of the recesses is shallowest immediately adjacent the tapered portion and is deepest immediately adjacent the spine.

10. The cutting blade of claim **1**, wherein both of the side surfaces of the blade include the broad recesses and the narrow supporting elements.

11. The cutting blade of claim **10**, wherein the broad recesses and the narrow supporting elements on one of the side surfaces are substantially symmetrical with the broad recesses and the narrow supporting elements on the other side surface.

12. (canceled)

13. The cutting blade of claim **1**, wherein at least one of the broad recesses has a vertical dimension in a direction from the cutting edge to the spine that is greater than a vertical dimension of either an adjoining portion of the tapered portion or an adjoining portion of the spine.

14. (canceled)

15. The cutting blade of claim **1**, wherein at least one of the narrow supporting elements is an elongated rib.

16. The cutting blade of claim **15**, wherein at least one of the elongated ribs tapers from a wider portion adjacent the tapered portion of the blade to a narrower portion adjacent the spine of the blade.

17. The cutting blade of claim **15**, wherein at least one of the elongated ribs tapers from a wider portion adjacent the spine of the blade to a narrower portion adjacent the tapered portion of the blade.

18. The cutting blade of claim **1**, wherein the elongated supporting elements are in the form of a plurality of fingers extending from the spine towards the tapered portion immediately adjacent the cutting edge of the blade with the recesses defined in spaces between adjacent pairs of the elongated supporting elements.

19. (canceled)

20. The cutting blade of claim **1**, wherein at least one of the narrow supporting elements extends at an incline from the tapered zone to the spine.

21. The cutting blade of claim **16**, wherein the incline is, at least in part, between **0** and **90** degrees or between **45** and **90** degrees from the tapered zone to the spine.

22. The cutting blade of claim **1**, wherein one of the side surfaces includes a plurality of channels extending from the tapered portion to the spine.

23. The cutting blade of claim **21**, wherein at least one of the channels has an open end at an edge of the blade adjoining the spine.

24-37. (canceled)

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