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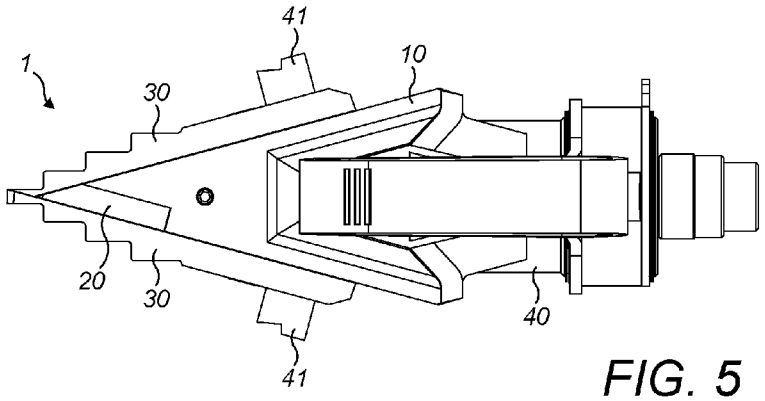

FIG. 5

(57) Abstract: A wedge mechanism for a separating tool incorporating a wedge that moves axially in the tool to lift a heavy item, or to separate two items that are forced together. The wedge has a body with an axis extending between a trailing end and a leading end, and the body tapers from the trailing end to the leading end. The leading end comprises a leading edge insert adapted to be removed from the body and replaced. The body of the wedge is cast, optionally from metal. The leading edge insert can be cast but is optionally formed by a different method than the body of the wedge, for example, by milling or forging from metal, and is optionally harder than the body.

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Wedge mechanism

The present invention relates to a wedge mechanism for a separating tool, optionally comprising a lifting or separating tool incorporating a wedge that moves axially in the tool to lift a heavy item, or to separate two items that are forced together. Examples of the invention are optionally useful in hydraulic or mechanical tools, and are optionally useful in tools that use high operating loads, to lift heavy objects, or to apply high forces to separate items that are forced together at high loads, e.g. pipeline flanges.

Lifting and separating tools have a wedge mechanism that drives a wedge axially in a body of the tool, typically between two plates or jaws disposed on opposing sides of the wedge. As the wedge is driven along an axis between the plates, the plates separate to apply a lifting or separating force to an object.

The invention provides a wedge for a separating tool, the wedge having a body with an axis extending between a trailing end and a leading end, and wherein the body tapers from the trailing end to the leading end, wherein the leading end comprises a leading edge insert adapted to be removed from the body and replaced.

According to the invention there is also provided a wedge mechanism for a separating tool, comprising: a wedge and a body which tapers from a trailing end to a leading end; and at least one plate, the wedge having an axis, and the plate and wedge being connected such that as the wedge moves parallel to the axis, the plate is moved radially away from the axis, and wherein the leading end comprises a leading edge insert adapted to be removed from the body and replaced.

The invention also provides a method of making a separating tool, the separating tool having a wedge mechanism comprising a wedge having an axis and a body and at least one plate, the method comprising connecting the plate to the wedge such that as the wedge moves parallel to the axis, the plate is moved radially away from

the axis, and providing the leading end of the body of the wedge with a leading edge insert adapted to be removed from the body and replaced, and wherein the method includes attaching the leading edge insert on the body by means of a releasable fixing.

The invention also provides a method separating two objects, comprising providing a wedge having an axis and a body and providing at least one plate, connecting the plate to the wedge such that as the wedge moves parallel to the axis, the plate is moved radially away from the axis, and providing the leading end of the body of the wedge with a leading edge insert adapted to be removed from the body and replaced, and wherein the method includes inserting the leading edge of the wedge between the two objects, with the plate disposed between the wedge and one of the objects, driving the wedge axially to drive the plate parallel to the axis, thereby driving the plate away from the axis of the body and separating the objects, and wherein the method includes attaching the leading edge insert on the body by means of a releasable fixing.

Optionally as the wedge moves parallel to the axis, the direction of movement of the plate in relation to the wedge can have a perpendicular component and a parallel component in relation to the axis. In certain examples of the invention, the plate is moved in a direction perpendicular to the axis.

By “separating” we include lifting, separating, and other similar acts.

Optionally the body of the wedge is cast, optionally from metal. The leading edge insert can be cast but is optionally formed by a different method than the body of the wedge, for example, by milling or forging from metal. Optionally the leading edge insert can be formed from rolled steel and can be machined, e.g. milled into a shape to form a part of the leading edge of the wedge body, or optionally forged. Optionally the leading edge insert is harder than the body. Optionally the leading edge insert comprises a harder material than the material of the body, or is formed

from the same material, but treated to make the leading edge insert harder than the body.

Optionally the leading edge insert is adapted to fit into a recess in the body of the wedge, and optionally is configured to continue the tapered surfaces of the wedge body. Optionally the recess is disposed at the leading end of the body. Optionally the recess and the insert have complimentary shapes so that the overall taper of the wedge body is maintained across the recess by the insert, without deviation of the outer surface of the body over the recess, when the insert is in place.

Optionally the insert is retained in the recess, optionally by a fixing such as a bolt or screw, which can optionally be removed to permit removal and replacement of the insert in the recess. Optionally the insert is removed and replaced when it shows signs of wear.

Optionally the recess is formed in the leading edge of the body of the wedge. Optionally the insert extends in an axial direction beyond the recess.

Optionally insert comprises a plate. Optionally the insert and the recess have generally flat surfaces, optionally with a generally rectangular shape, at least at the trailing end of the insert. Optionally the insert has a leading edge that is tapered at the same taper as the body, and which optionally extends from the recess, at the leading end.

Optionally the recess and the insert have flat surfaces, optionally rectilinear surfaces, optionally with at least two rectangular faces. Optionally at least one face of the recess is disposed axially behind the insert, to buttress the insert against axial movement in the recess. Optionally that face is flat, and in particular examples could be rectangular. The buttressing face does not need to be perpendicular to the axis, or to the face of the body, but merely needs to resist axial movement of the insert in the recess.

Optionally the leading edge insert forms the leading edge of the wedge body.

Optionally the plate slides over the outer surface of the leading edge insert. Optionally the inner surface of the leading edge insert is pressed into the recess. Optionally the inner and outer surfaces of the leading edge insert meet at a tip.

Optionally the or each plate is retained on the body by a retainer arm, or by a respective retainer arm in the case of more than one plate. Optionally the retainer arm extends radially away from the axis of the body, and optionally has a leading face and a trailing face. Optionally the trailing face and/or the leading face can optionally be canted at an angle toward the leading end of the wedge with respect to the axis, but optionally at least one of the trailing and leading faces (or both of them) is perpendicular to the face of the body on which the plate is engaged. Optionally the leading face of the arm is perpendicular to the axis. Optionally the leading and trailing faces of the arm can be parallel but this is not necessary and in some examples of the invention the leading and trailing faces are optionally not parallel. Optionally the plate has an aperture that receives the radial extension of the arm, and optionally the plate slides along the trailing face of the arm, at the angle defined by the trailing face of the arm.

The various aspects of the present invention can be practiced alone or in combination with one or more of the other aspects, as will be appreciated by those skilled in the relevant arts. The various aspects of the invention can optionally be provided in combination with one or more of the optional features of the other aspects of the invention. Also, optional features described in relation to one example can optionally be combined alone or together with other features in different examples of the invention.

Various examples and aspects of the invention will now be described in detail with reference to the accompanying figures. Still other aspects, features, and advantages of the present invention are readily apparent from the entire description thereof, including the figures, which illustrates a number of exemplary aspects and

implementations. The invention is also capable of other and different examples and aspects, and its several details can be modified in various respects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and descriptions are to be regarded as illustrative in nature, and not as restrictive. Furthermore, the terminology and phraseology used herein is solely used for descriptive purposes and should not be construed as limiting in scope. Language such as "including," "comprising," "having," "containing," or "involving," and variations thereof, is intended to be broad and encompass the subject matter listed thereafter, equivalents, and additional subject matter not recited, and is not intended to exclude other additives, components, integers or steps. Likewise, the term "comprising" is considered synonymous with the terms "including" or "containing" for applicable legal purposes.

Any discussion of documents, acts, materials, devices, articles and the like is included in the specification solely for the purpose of providing a context for the present invention. It is not suggested or represented that any or all of these matters formed part of the prior art base or were common general knowledge in the field relevant to the present invention.

In this disclosure, whenever a composition, an element or a group of elements is preceded with the transitional phrase "comprising", it is understood that we also contemplate the same composition, element or group of elements with transitional phrases "consisting essentially of", "consisting", "selected from the group of consisting of", "including", or "is" preceding the recitation of the composition, element or group of elements and vice versa.

All numerical values in this disclosure are understood as being modified by "about". All singular forms of elements, or any other components described herein are understood to include plural forms thereof and vice versa. References to positional descriptions such as "upper" and "lower", and directions such as "up", "down" etc in relation to the invention are to be interpreted by a skilled reader in the context of the examples described and are not to be interpreted as limiting the invention to the

literal interpretation of the term, but instead should be as understood by the skilled addressee.

In the accompanying drawings,

Fig 1 is a side view of a wedge body for use in a wedge mechanism;

Fig 2 is a plan view from beneath the fig 1 body;

Fig 3 is a perspective view of the fig 1 body;

Fig 4 is an exploded perspective view similar to fig 3;

Fig 5 is a side view of a separating tool incorporating the wedge body of fig 1, in which the piston is retracted;

Fig 6 is a side sectional view of the fig 5 tool, in which the piston is retracted;

Figs 7 and 8 are side and section views similar to figs 5 and 6, but with the piston extended;

Figs 9 and 10 are plan and section views from above of the tool of fig 5, with the piston retracted;

Figs 11 and 12 are plan and sectional views similar to figs 9 and 10, with the piston extended;

Figs 13 and 14 are perspective views of the tool with the piston retracted and extended respectively;

Figs 15 and 16 are partial perspective views of the tool shown in fig 5 with certain components removed for clarity; and

Fig 17 shows an exploded view of the tool shown in Fig 5.

Referring now to the drawings a wedge mechanism comprises a wedge having a body 10 with upper and lower faces 11, 12, which taper from a trailing end to a leading end. At the leading end the faces 11, 12 converge towards a tip, at which is located a leading edge insert 20 in the form of a generally flat plate, which is secured in a recess 15 on the body 10 of the wedge. The insert 20 has a flat outer surface 21 and a parallel flat inner surface 22, and generally flat sides, and optionally all of the surfaces are generally rectilinear. Three of the flat sides of the insert 20 are optionally perpendicular to the inner and outer surfaces, and one side is chamfered as will be discussed in more detail below.

The depth, width (and optionally the length) of the recess 15 optionally matches the corresponding depth and width of the side walls of the insert 20. Thus when the insert 20 is located in the recess 15, the flat outer face 21 of the insert 20 is optionally continuous with the flat upper face 11 of the body 10, so that the insert effectively continues the flat upper surface 11 un-interrupted across the recess. Optionally the leading-edge 20l of the insert 20 is chamfered to match the taper of at least one of the upper and lower surfaces 11, 12 of the body 10, and optionally the leading-edge 20l of the insert 20 extends from the body to form the apex of the wedge, protruding out of the recess 15, so that when the insert 20 is secured in place in the recess 15 on the body 10, the leading-edge of the wedge is formed entirely by the insert 20, which optionally extends in an axial direction out of the leading end of the body, by about 1 to 3 cm beyond the axial limits of the recess, as best seen in fig 1.

The outer face 21 of the insert 20 is flat all the way to the leading edge 20l. The opposite lower face of the plate which engages the outer surface of the recess 15 is chamfered or tapered as best seen in fig 1, to match the taper of the lower face 12 of the body 10. Accordingly the shape of the insert 20 engaged in the recess is complementary to the shape of the recess, and the insert 20 blends into the lower and upper tapered faces 11, 12 of the body 10, when secured in the recess 15, as best seen in fig 1, continuing these surfaces without interruption.

The insert 20 optionally has a plain aperture extending between its inner and outer faces 21, 22 to receive a threaded fixing such as a bolt, which passes through the insert 20, and engages in a threaded aperture in the face of the recess 15, to secure the insert 20 releasably to the body 10, in a manner than secures the insert 20 in place, but allows its quick removal by loosening the fixing in the event of damage to the insert 20.

Optionally the recess 15 has a support wall 16 that is perpendicular to the face of the recess, and perpendicular to the face of the surface 11 to provide a backstop for

the insert 20 when secured in the recess, so that forces applied to the insert 20 by the plates when the wedge is driven axially between the plates are transferred to the wall 16 rather than to the threaded fixing alone, although the threaded fixing can optionally bear some of the forces applied to the insert 20. Accordingly the insert is buttressed from below and behind by the body, so point loads applied to the insert 20 during operation of the separating tool are spread evenly around the body 10.

The upper and lower faces 11, 12 of the body 10 optionally have slots 13 (see Fig 2) extending in line with the axis x-x of the body 10. The upper and lower faces 11, 12 are optionally connected by sides. The trailing end of the wedge body 10 is optionally open to receive a driver device, such as a hydraulic cylinder, although not all examples of the invention need to be hydraulic, and some drivers can comprise a mechanical system with a threaded stem and a captive nut for example.

As shown in Figs 5-17, the wedge body 10 can be used in a wedge tool 1 having at least one plate 30. Two plates 30 (upper and lower) are shown in this example, disposed on opposite upper and lower faces 11, 12 of the wedge body 10. The plates 30 optionally have steps and interlocking castellations, and optionally have apertures 31 which line up with the slots 13 in the body 10.

The wedge 10 is driven in an axial direction by a hydraulic cylinder 40 having a piston 50, which extends from the cylinder 40 to drive the wedge 10 axially between the plates 30, which causes the plates to move radially apart in opposite directions away from the axis x-x, with a slight axial component as well as radially relative to the axis x-x; in this example, the plates 30 in the direction of the arrows in Fig 7. The angle of radial movement of the plates 30 relative to the axis x-x is determined by optional retainer arms 41 which extend radially from the body 10, through the slots 13 in the body, and through the apertures 31 in the plates 30, to prevent, or at least restrict, the axial movement of the plates 30 relative to the cylinder 40 while the piston 50 is driven axially to move the wedge body 10 along the axis x-x. The arms 41 are mounted on an collar which supports the arms 41 and which has a central bore to receive the piston 50. The collar slots over the piston 50, and is

received in the space formed between the side walls extending between the faces 11, 12. Optionally the side walls have a profiled inner recess that receives the collar and the cylinder 40, and the arms 41 extend out of the slots 13 in the faces 11, 12. The collar is prevented from rotation relative to the body 10 by the arms 41 extending through the slots 13, and by the profile of the recess in the space between the side walls.

The arms 41 each have a leading face and a trailing face, which in this example are optionally non parallel to one another; the leading face closest to the leading end of the body is optionally perpendicular to the axis of the body. Optionally the trailing face is perpendicular to the face of the body on which the respective plate is engaged. In certain other examples of the invention, the leading and trailing faces of the arms can be mutually parallel. Optionally each plate slides along the trailing face of the arm 41, at the angle defined by the trailing face of the arm 41.

The wedge body 10 slides underneath the plates 30, so that the smooth opposite tapered faces 11, 12 of the wedge body 10 slide along the smooth inner surfaces of the plates 30. The upper face 21 of the insert 20 forms a continuous flat surface with the upper face 11, and the chamfered or tapered lower face 22 likewise forms a continuous flat surface with the lower face 12, so that the plates 30 slide over the insert 20 and wedge body 10 alike, without restriction by the insert 20.

A spring device provided optionally within the bore of the piston 50 is optionally held in tension as the piston 50 extends from the cylinder 40, and optionally returns the piston to its starting position shown in Fig 5 in the absence of other forces. The plates 30 are optionally secured to the body 10 with a T-headed sliding arrangement via bolts 35 and sliders 36, which are secured to the inner surfaces of the plates 30, but which slide under the inner edges of the slots 13 in the body 10, thereby holding the plates 30 onto the tools 1 in the absence of other forces, but allowing the wedge 10 to slide relative to the plates 30 as it advances as a result of the extension of the piston 50.

Optionally the body 11 of the wedge is cast, optionally from metal such as steel. The insert 20 can also be cast but in this example, the insert 20 is optionally formed by machining a piece of rolled forged steel, optionally a tool steel or other harder metal as compared with the remainder of the body 10. The insert 20 is optionally milled from a flat piece of rolled steel, and optionally the leading edge 20l is formed by chamfering it with the same tapered angle as the lower face 12 of the wedge body 10.

As the insert 20 is retained in the recess by a fixing such as a bolt or screw, it can be removed quickly if damaged or worn to permit replacement of the insert 20 in the recess 15 without dis-assembling re-dressing the remainder of the tool, or replacing the body 10. Optionally the insert is removed and replaced when it shows signs of wear, for example, bending, scratching, cracking etc. Optionally the insert can be removed simply by removing the plate on the recessed face 11, without requiring further dis-assembly of the device.

To facilitate removal and replacement of the insert 20, the tool 1 is placed in the configuration shown in Fig 14, with the insert 20 exposed beyond the limits of the plates 30, and the fixing securing the insert 20 to the recess 15 is removed. If the insert 20 becomes buckled or scratched or cracked this can cause irregularities in the surfaces 11, 12, which can affect the freedom of the plates 30 to slide freely over the advancing and retreating wedge body 10, which can worsen any asymmetrical distribution of forces on the plates, increasing the buckling of other components, and increasing the risk of failure under load, potentially causing injury to the user. Having a replaceable insert 20 means that the insert can be replaced when the damage is minimal, thereby reducing the risks of damaging other parts of the device. Also, the insert can be formed from a harder material and be less likely to deform under radial loadings applied to the plates 30 at the leading edge, and hence the initial deformation that leads to damage to other components can be avoided or reduced. Furthermore the body 10 can be formed in a single piece from cast material allowing considerable design freedom in selecting different shapes and functions of the body, and greater efficiencies in manufacturing.

Claims

1. A wedge mechanism for a separating tool, comprising: a wedge and a body which tapers from a trailing end to a leading end; and at least one plate, the wedge having an axis, and the plate and wedge being connected such that as the wedge moves parallel to the axis, the plate is moved radially away from the axis, and wherein the leading end comprises a leading edge insert adapted to be removed from the body and replaced.

2. A wedge mechanism as claimed in claim 1, wherein the body of the wedge is cast from metal.

3. A wedge mechanism as claimed in claim 1 or claim 2, wherein the leading edge insert is formed by a different method than the body of the wedge.

4. A wedge mechanism as claimed in claim 3, wherein the body of the wedge is cast from metal and the leading edge insert is milled or forged from metal.

5. A wedge mechanism as claimed in claim 4, wherein the leading edge insert is formed from rolled steel into a shape to form a part of the leading edge of the wedge body.

6. A wedge mechanism as claimed in any one of claims 1-5, wherein the leading edge insert is harder than the body.

7. A wedge mechanism as claimed in claim 6, wherein the leading edge insert is formed from a material that is harder than the material forming the body.

8. A wedge mechanism as claimed in claim 7, wherein the leading edge insert is treated to make the leading edge insert harder than the body.

9. A wedge mechanism as claimed in any one of claims 1-8, wherein the leading edge insert is shaped to fit into a recess in the body of the wedge.

10. A wedge mechanism as claimed in claim 9, wherein the leading edge insert is configured to continue the tapered surfaces of the wedge body.

11. A wedge mechanism as claimed in any one of claims 9- 10, wherein the recess receiving the leading edge insert is disposed at the leading end of the body.

12. A wedge mechanism as claimed in any one of claims 9-11, wherein the recess and the insert have complimentary shapes so that the overall taper of the wedge body is maintained across the recess by the insert, without deviation of the outer surface of the body over the recess, when the insert is in place.

13. A wedge mechanism as claimed in any one of claims 9-12, wherein the insert is retained in the recess by a removable fixing which can be removed to permit removal and replacement of the insert in the recess.

14. A wedge mechanism as claimed in any one of claims 9-13 wherein the insert extends in an axial direction beyond the recess.

15. A wedge mechanism as claimed in any one of claims 9-14 wherein the insert has a leading edge that is tapered at the same taper as the body, and which extends in an axial direction from the recess, at the leading end of the body.

16. A wedge mechanism as claimed in any one of claims 9-15, wherein the insert comprises a plate, and wherein the insert and the recess have rectilinear flat surfaces.

17. A wedge mechanism as claimed in claim 16, wherein the recess and the insert respectively have at least one flat opposing face, and wherein the face of the recess is disposed axially behind the opposing face of the insert, whereby the face of the recess acts to buttress the insert against axial movement within the recess.

18. A wedge mechanism as claimed in any one of claims 1-17, wherein the plate slides over the outer surface of the leading edge insert.

19. A wedge mechanism as claimed in any one of claims 1-18 wherein the inner and outer surfaces of the leading edge insert meet at a tip at the leading edge of the insert.

20. A wedge mechanism as claimed in any one of claims 1-19, wherein the plate is retained on the body by a retainer arm.

21. A wedge mechanism as claimed in claim 20, wherein the retainer arm extends radially away from the axis of the body, and has a leading face and a trailing face, and wherein the retainer arm extends through an aperture through the plate.

22. A wedge mechanism as claimed in claim 21, wherein the leading and trailing faces of the arm are non-parallel, and wherein the plate slides along the trailing face of the arm, at the angle defined by the trailing face of the lug.

23. A wedge mechanism as claimed in claim 21 or 22, wherein the trailing face of the arm is parallel to the face of the body on which the plate is slidably mounted, whereby the plate moves perpendicularly to the face of the body as the wedge moves axially with respect to the axis of the body.

24. A wedge mechanism as claimed in any one of claims 21-23, wherein the leading face of the arm is parallel to the axis of the body.

25. A method of making a separating tool, the separating tool having a wedge mechanism comprising a wedge having an axis and a body and at least one plate, the method comprising connecting the plate to the wedge such that as the wedge moves parallel to the axis, the plate is moved radially away from the axis, and providing the leading end of the body of the wedge with a leading edge insert adapted to be removed from the body and replaced, and wherein the method includes attaching the leading edge insert on the body with a releasable fixing.

26. A method as claimed in claim 25, including the step of forming the leading edge insert from a different material than the body.

27. A method as claimed in claim 25 or 26, including the step of making the leading edge insert harder than the body.

28. A method as claimed in any one of claims 25-27, including casting the body from metal.

29. A method as claimed in any one of claims 25-28, wherein the leading edge insert is formed by a different method than the body of the wedge.

30. A method as claimed in any one of claims 25-29, including milling the leading edge insert from metal.

31. A method as claimed in any one of claims 25-30, including forging the leading edge insert from metal.

32. A method as claimed in any one of claims 25-31, including forming the leading edge insert from rolled steel into a shape to form a part of the leading edge of the wedge body.

33. A method as claimed in any one of claims 25-32, including retaining the leading edge insert in a recess in the body of the wedge.

34. A method as claimed in claim 33, including forming the leading edge insert with outer surfaces that continue the tapered surfaces of the wedge body across the recess.

35. A method as claimed in claim 33 or 34 wherein the recess receiving the leading edge insert is disposed at the leading end of the body.

36. A method as claimed in any one of claims 33-35, including retaining the insert in the recess by a removable fixing and removing the fixing to release the insert from the recess.

37. A method as claimed in any one of claims 33-36, including sliding the plate over the outer surface of the leading edge insert.

38. A method as claimed in any one of claims 33-37, including retaining the plate against axial movement with respect to the body by a retainer arm.

39. A method as claimed in claim 38, wherein the retainer arm extends radially away from the axis of the body, and has a leading face and a trailing face, and wherein the retainer arm extends through an aperture through the plate.

40. A method as claimed in claim 39, wherein the leading and trailing faces of the arm are non-parallel, and including sliding the plate along the trailing face of the arm, at the angle defined by the trailing face of the lug, when the wedge moves axially.

41. A method as claimed in claim 39 or 40, including moving the plate perpendicularly with respect to the face of the body as the wedge moves axially with respect to the axis of the body by retaining the plate on the trailing face of the arm.

42. A method of separating two objects, comprising providing a wedge having an axis and a body and providing at least one plate, connecting the plate to the wedge such that as the wedge moves parallel to the axis, the plate is moved radially away from the axis, and providing the leading end of the body of the wedge with a leading edge insert adapted to be removed from the body and replaced, and wherein the method includes inserting the leading edge of the wedge between the two objects, with the plate disposed between the wedge and one of the objects, driving the wedge axially to drive the plate parallel to the axis, thereby driving the plate away from the axis of the body and separating the objects, and wherein the method includes attaching the leading edge insert on the body by means of a releasable fixing.

43. A method as claimed in claim 42, including the step of forming the leading edge insert from a different material than the body.

44. A method as claimed in claim 42 or 43, including the step of making the leading edge insert harder than the body.

45. A method as claimed in any one of claims 42-44, including casting the body from metal.

46. A method as claimed in any one of claims 42-45, including forming the leading edge insert by a different method than the body of the wedge.

47. A method as claimed in any one of claims 42-46, including milling the leading edge insert from metal.

48. A method as claimed in any one of claims 42-47, including forging the leading edge insert from metal.

49. A method as claimed in any one of claims 42-48, including forming the leading edge insert from rolled steel into a shape to form a part of the leading edge of the wedge body.

50. A method as claimed in any one of claims 42-49, including retaining the leading edge insert in a recess in the body of the wedge.

51. A method as claimed in claim 50, including forming the leading edge insert with outer surfaces that continue the tapered surfaces of the wedge body across the recess.

52. A method as claimed in claim 50 or 51 wherein the recess receiving the leading edge insert is disposed at the leading end of the body.

53. A method as claimed in any one of claims 42-52, including retaining the insert in the recess by a removable fixing, and removing the fixing to release the insert from the recess.

54. A method as claimed in any one of claims 42-53, including sliding the plate over the outer surface of the leading edge insert.

55. A method as claimed in any one of claims 42-54, including retaining the plate against axial movement with respect to the body by a retainer arm.

56. A method as claimed in claim 55, wherein the retainer arm extends radially away from the axis of the body, and has a leading face and a trailing face, and wherein the retainer arm extends through an aperture through the plate.

57. A method as claimed in claim 56, wherein the leading and trailing faces of the arm are non-parallel, and including sliding the plate along the trailing face of the arm, at the angle defined by the trailing face of the lug, when the wedge moves axially.

58. A method as claimed in claim 56 or 57, including moving the plate perpendicularly with respect to the face of the body as the wedge moves axially with respect to the axis of the body by retaining the plate on the trailing face of the arm.

59. A wedge for a separating tool, the wedge having a body having an axis extending between a trailing end to a leading end, and wherein the body tapers from the trailing end to the leading end, wherein the leading end comprises a leading edge insert adapted to be removed from the body and replaced.

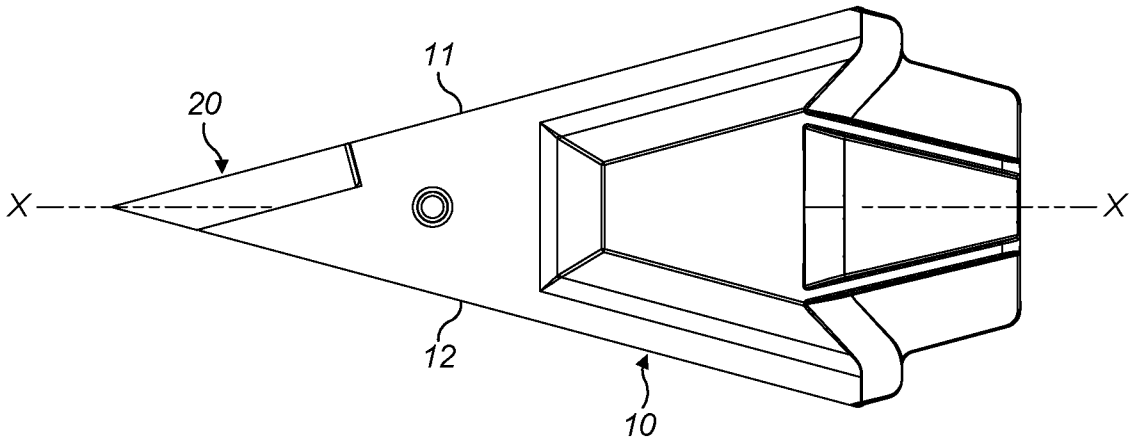

FIG. 1

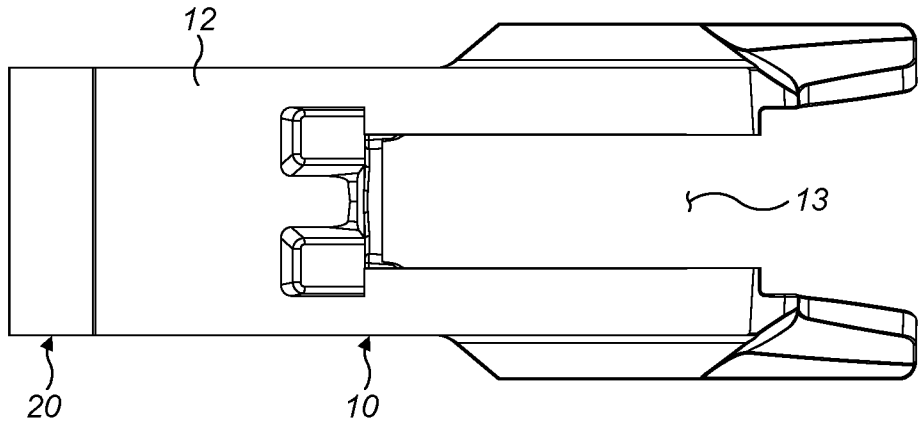

FIG. 2

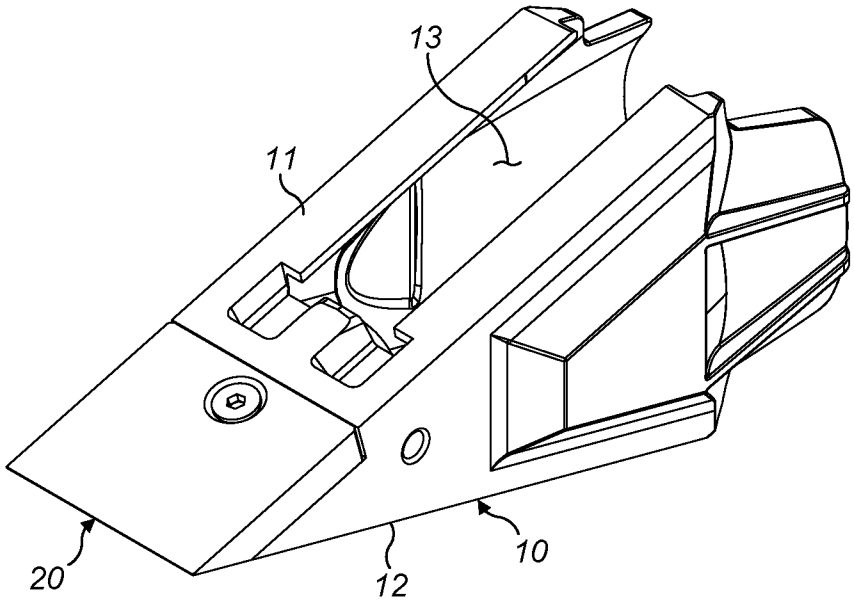

FIG. 3

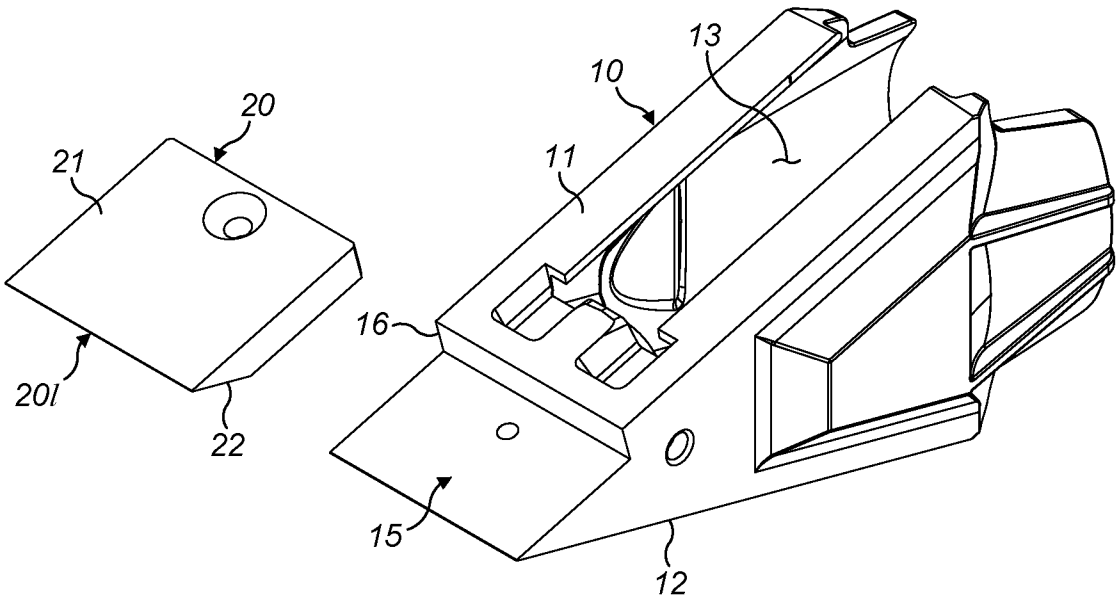

FIG. 4

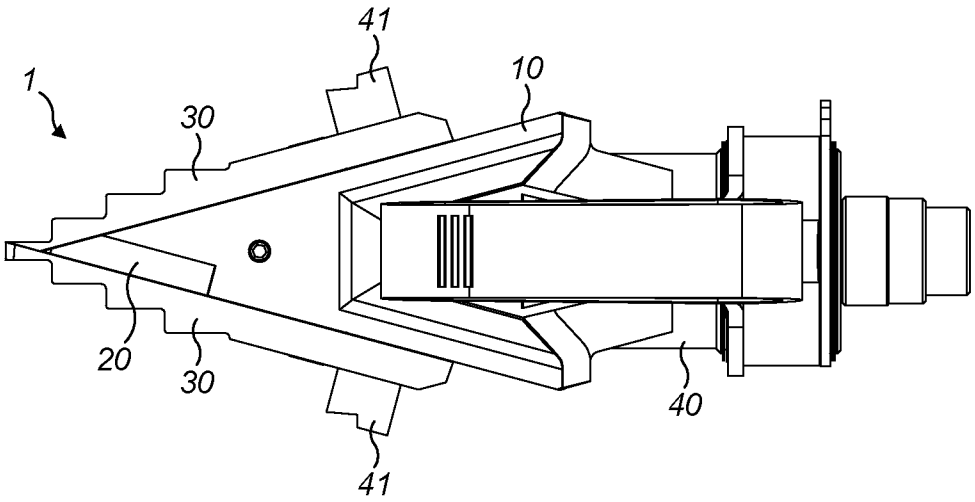

FIG. 5

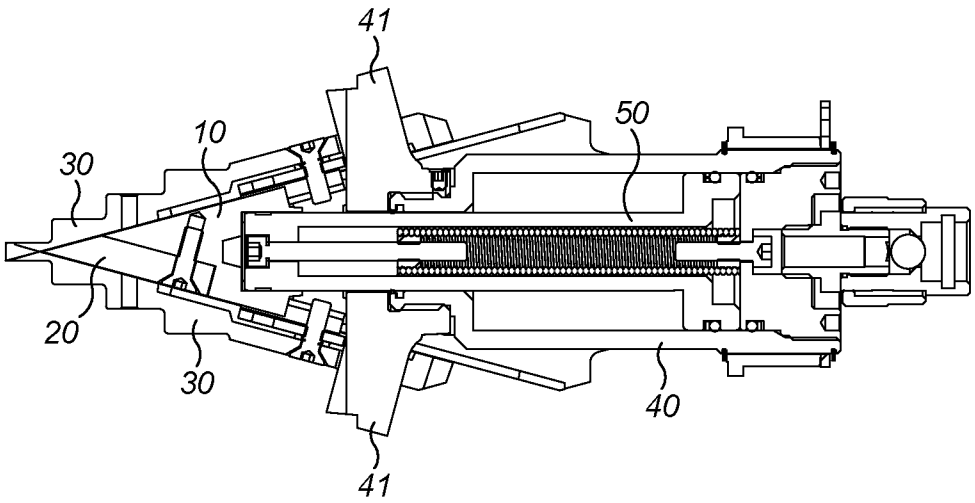

FIG. 6

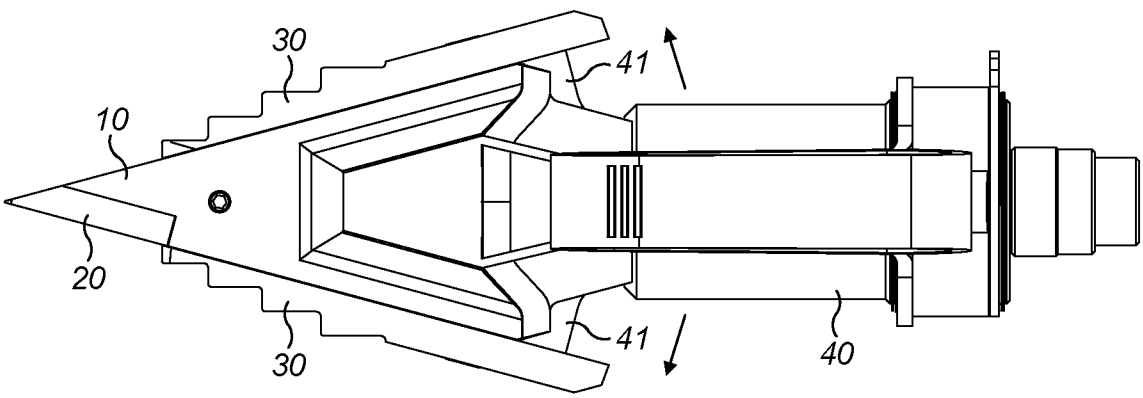

FIG. 7

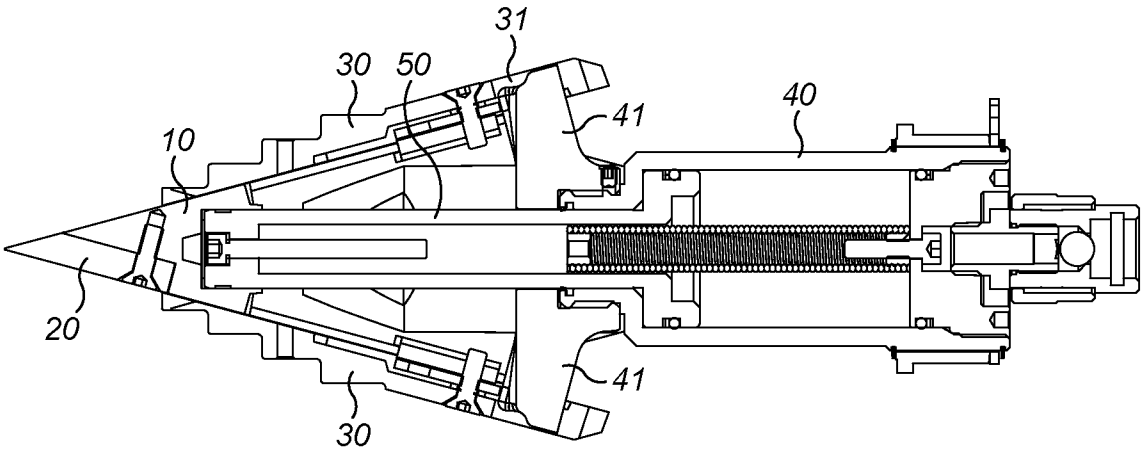

FIG. 8

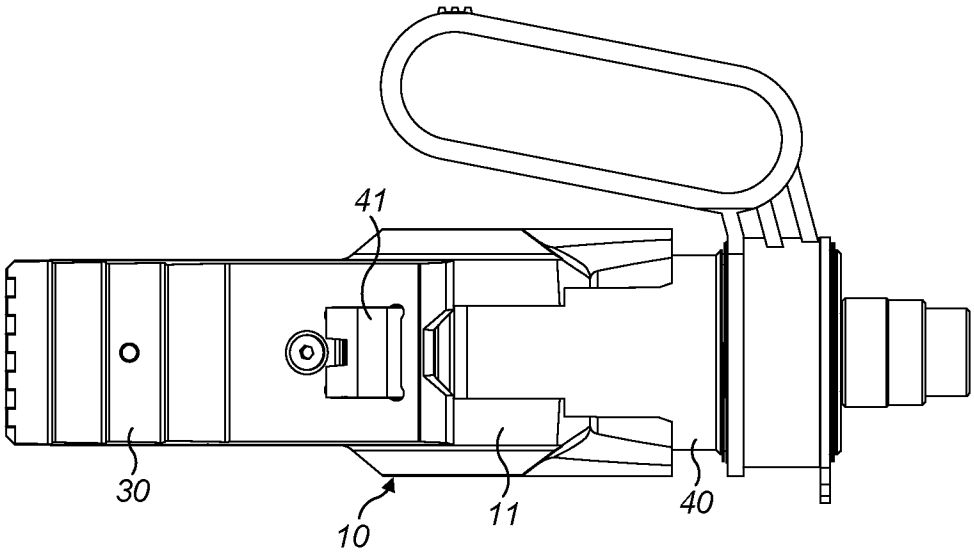

FIG. 9

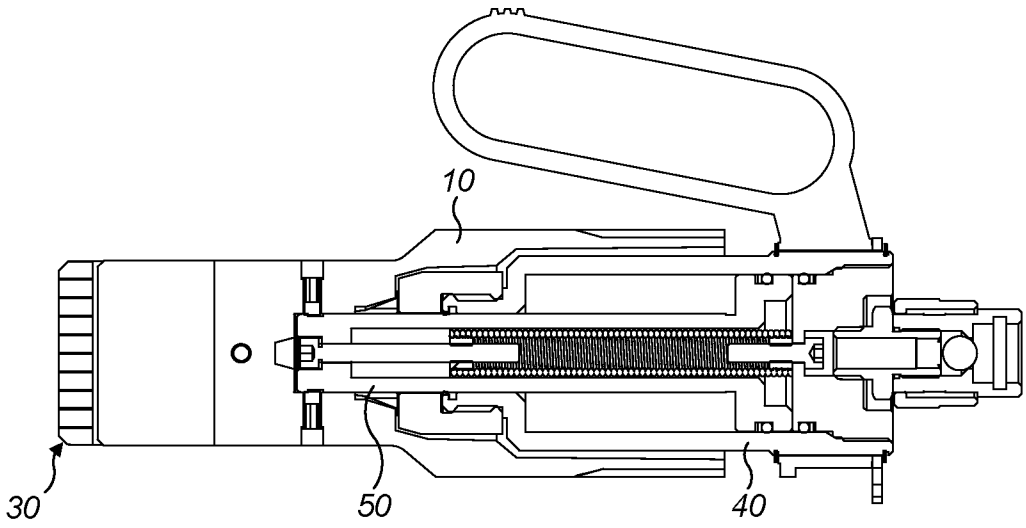

FIG. 10

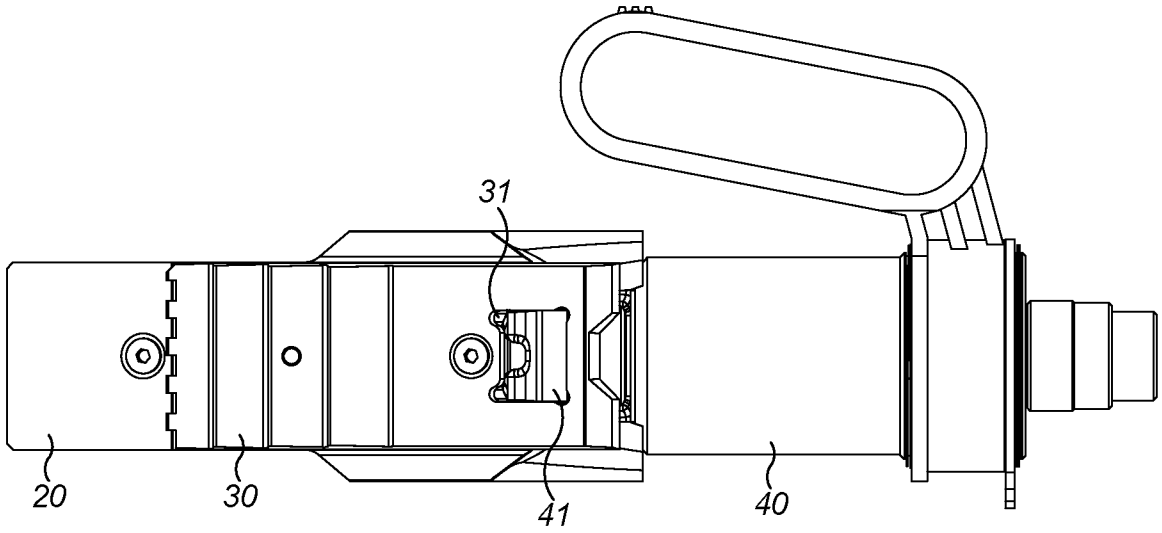

FIG. 11

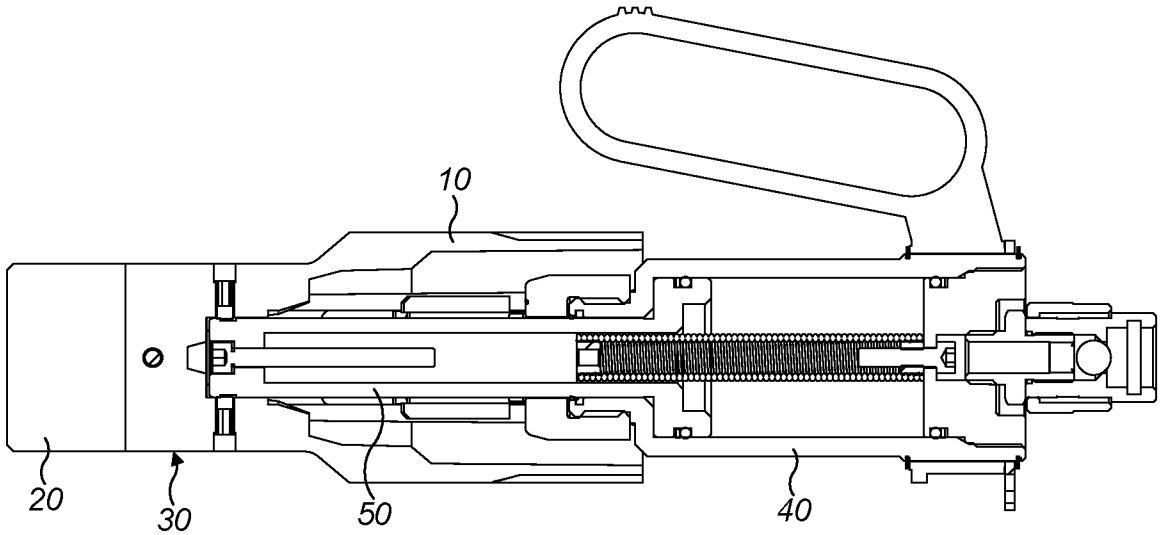

FIG. 12

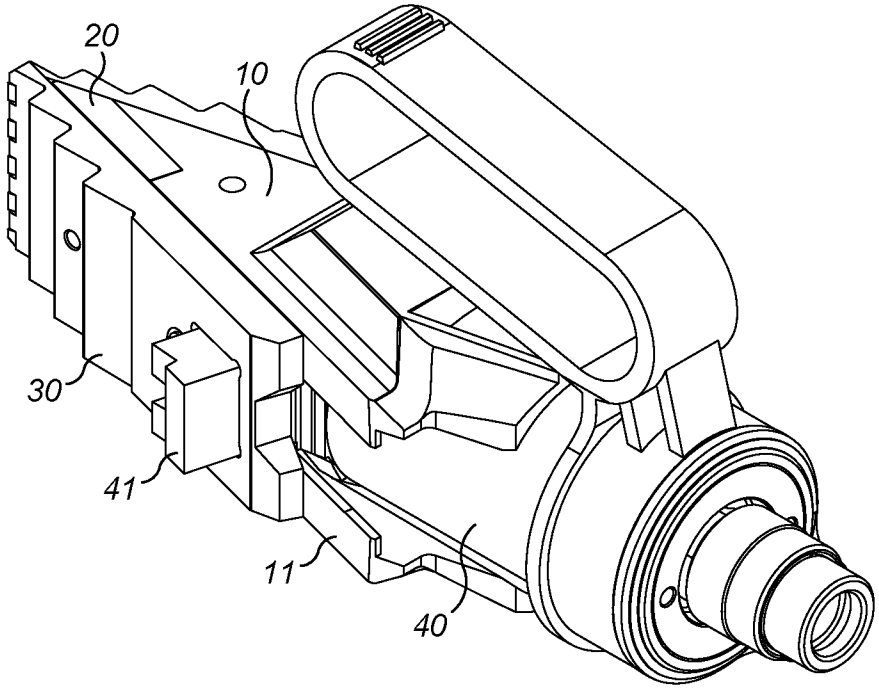

FIG. 13

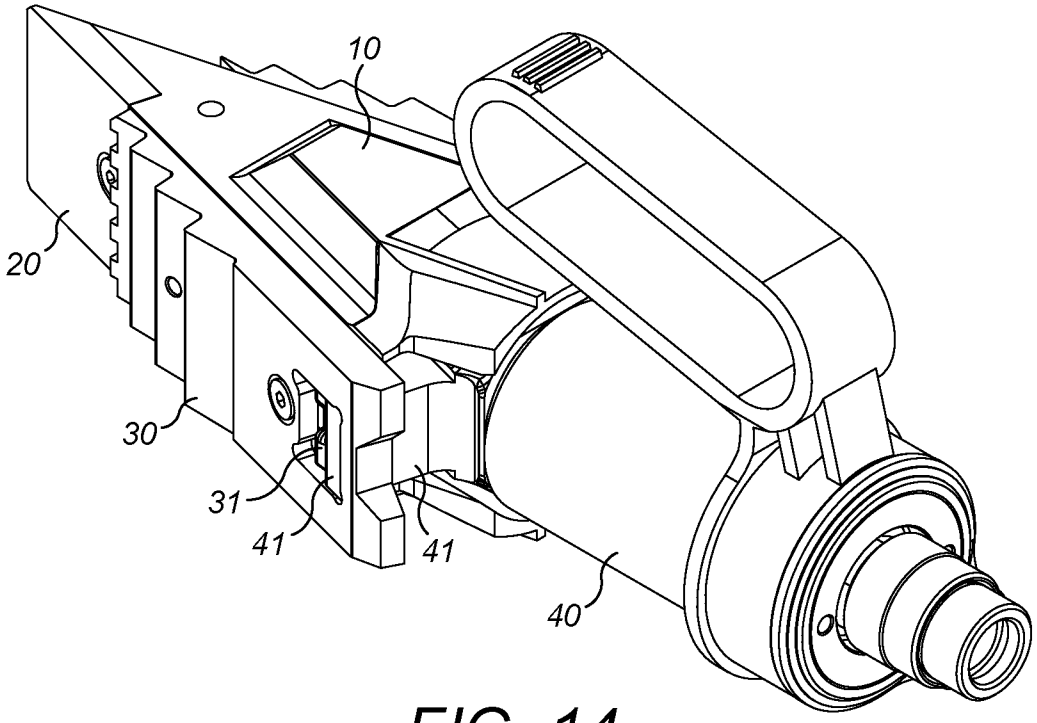

FIG. 14

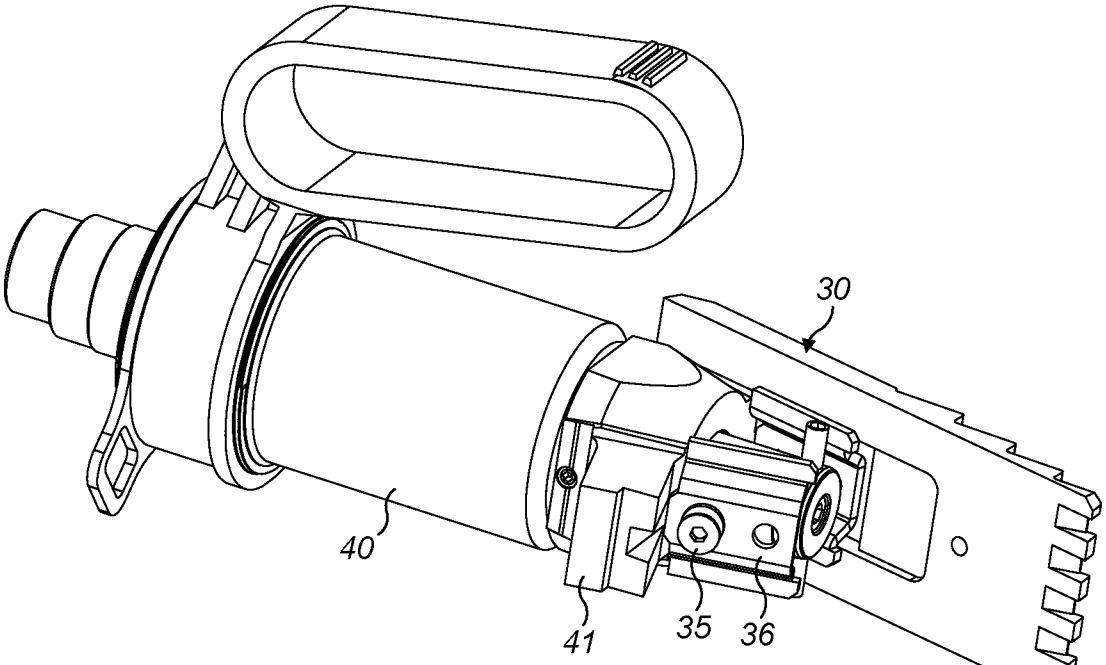

FIG. 15

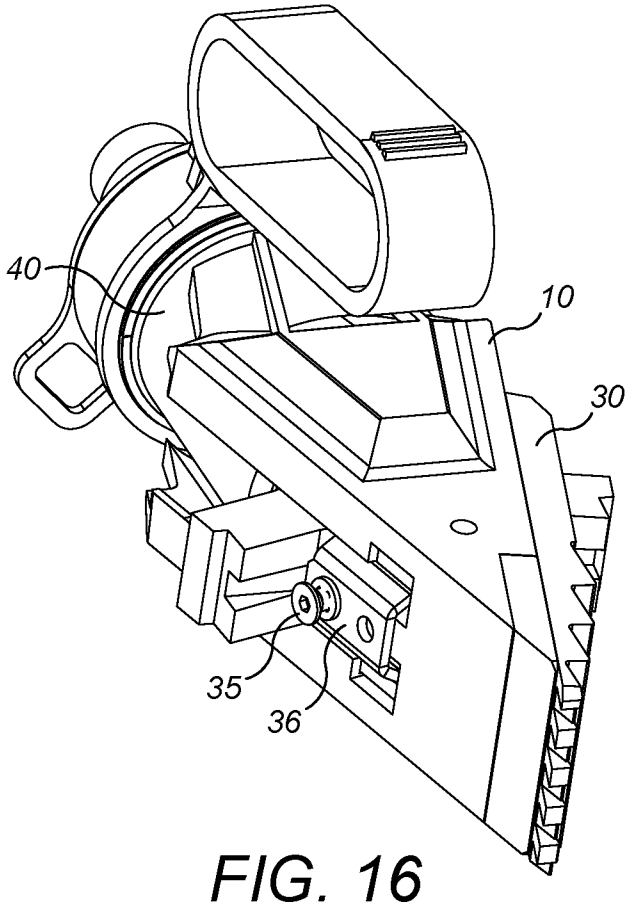

FIG. 16

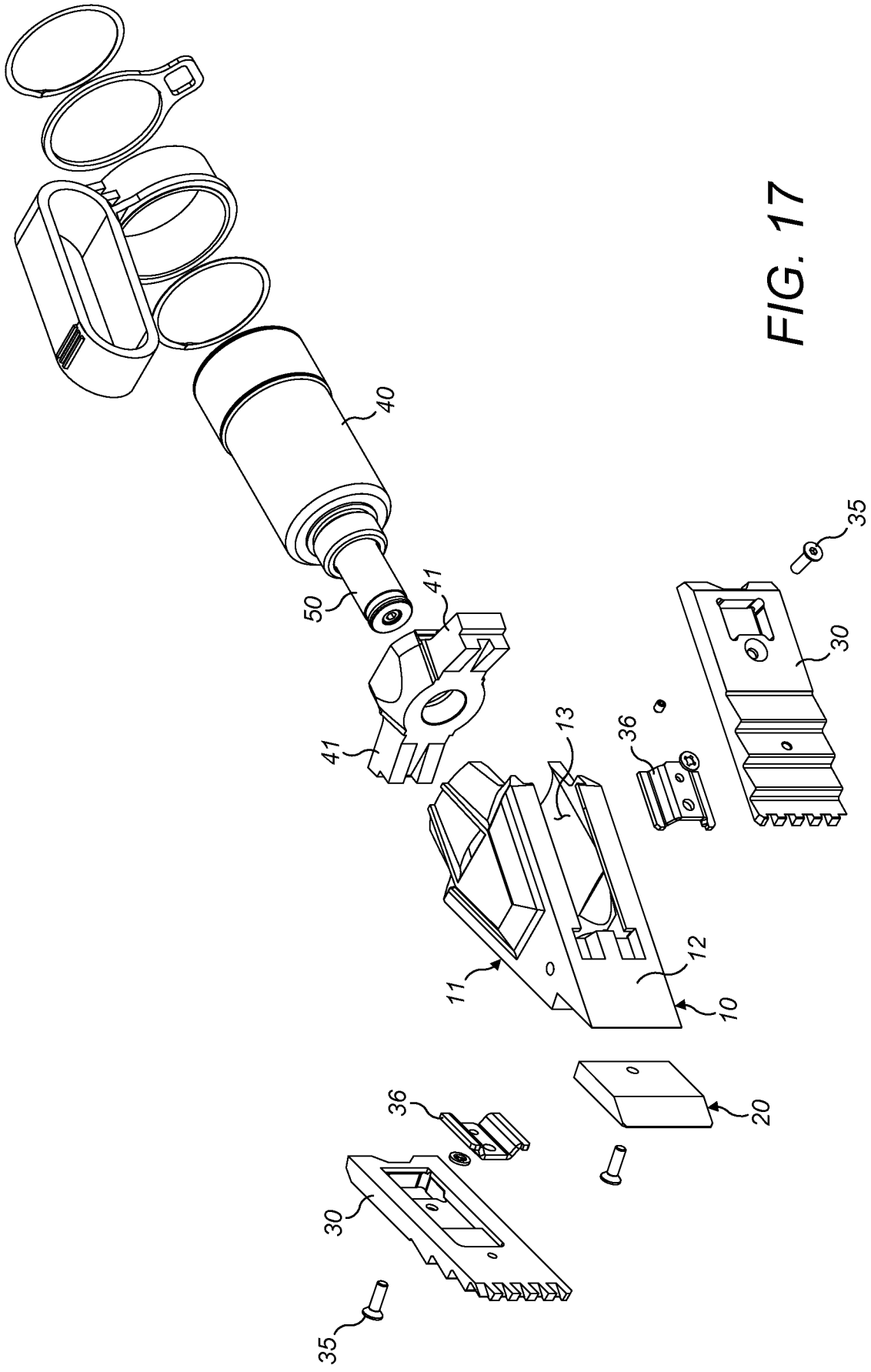

FIG. 17

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2014/051232

A. CLASSIFICATION OF SUBJECT MATTER
INV. B25B27/16 A62B3/00 B27L3/00 B25D3/00 B66F19/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B25B A62B B27L B25D B66F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 92/14674 A1 (TILMAN PAUL LOUIS JOSEPH [BE]) 3 September 1992 (1992-09-03)	42-55
A	the whole document	1,25
X	WO 98/47809 A1 (FUTURE ALIGNMENTS LIMITED [GB]; STEPHEN ROBERT [GB]) 29 October 1998 (1998-10-29)	42-55
A	abstract; claims; figures	1,25
X	WO 00/57957 A1 (HOLMATRO IND EQUIP [NL]; PAULEN THOMAS GIJSBERT [NL]; BLAAS RONALD PET) 5 October 2000 (2000-10-05)	42-55
A	abstract; claims; figures	1,25
X	DE 203 18 458 U1 (LINKE SANDER [DE]) 22 April 2004 (2004-04-22) claims; figures 1,2	59

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
2 July 2014	10/07/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Majerus, Hubert

1

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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2014/051232

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CH 684 635 A5 (ERNST ROTH MANFRED KRAEHENBUEH) 15 November 1994 (1994-11-15) column 1, line 38 - line 48; claim; figures 1,2	59

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2014/051232

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