(12) STANDARD PATENT APPLICATION (11) Application No. **AU 2023203223 A1**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
Attachment assembly and ground engaging assembly for earthmoving equipment

(51) International Patent Classification(s)
E02F 9/28 (2006.01)

(21) Application No: **2023203223** (22) Date of Filing: **2023.05.23**

(43) Publication Date: **2023.06.15**
(43) Publication Journal Date: **2023.06.15**

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Abstract

An attachment assembly (**25**) and a ground engaging assembly for releasable attachment with earthmoving equipment is disclosed. In at least one embodiment, the attachment assembly (**25**) comprises a first body (**30**) configured for being placed in affirmative engagement with a portion (**32**) of or in fixed relation with respect to an edge of or associated with the earthmoving equipment. The attachment assembly (**25**) comprises a second body (**35**) configured for being placed in affirmative engagement with a portion of the ground engaging tool (***GET***, **15c** or **15**). An operable element (**40**) is arranged so as to operably associate the first (**30**) and second (**35**) bodies so as to be responsive to operation of the operable element (**40**) in a first mode (mode `I`), in which one of the bodies (**30**, **35**) is moved or driven away from the alternate body on the GET being received with respect to said edge, the separation of the bodies operating to apply a force to said portion of the GET for holding the GET (**15c**) with respect to said edge, and, a second mode of operation (mode `II`), in which one of the bodies is driven/moved toward the alternate body for removal of the GET (**15c**). Embodiments of a ground engaging assembly are also disclosed.

Attachment assembly and ground engaging assembly for earthmoving equipment

Field of the Invention

[001] An attachment assembly for releasably attaching a ground engaging tool to earthmoving machinery is disclosed. A ground engaging assembly for use with earthmoving machinery is also disclosed.

Related applications

[002] The present application claims divisional status from Australian patent application No. 2021355551 ('551), which itself claims priority to Australian provisional patent application No. 2020903512 ('512) filed 29 September 2020, and Australian patent appication No. 2021221771 ('771) filed 25 August 2021. The contents of '551, '512, and '771 are incorporated herein by reference in their entirety.

Background

[003] Ground engaging tools (***GET***) such as for example teeth and shrouds used on the edge or edges of excavator buckets of earthmoving equipment in mining operations, operate in highly abrasive environments, are subjected to high impact forces and therefore wear out or become damaged through use. As such, GETs tend to require regular replacement once they come to the end of their useful life.

[004] Depending on how the GET is attached to its host excavator bucket, their replacement can be complex, time-consuming and relatively expensive.

[005] Accordingly, it is posited that there exists a need/market for a solution that seeks to provide a balance to the above considerations. It is therefore against this general background that the embodiments described herein have been developed.

Summary

[006] According to a first aspect, there is provided an attachment assembly for releasably securing a ground engaging tool (GET) with earthmoving equipment, the attachment assembly comprising:

a first body configured for placement in affirmative engagement with a portion of or in fixed relation with respect to an edge of or associated with the earthmoving equipment;

a second body configured for placement in affirmative engagement with a portion of the GET;

an operable element operably associating the first and second bodies so as to be responsive to operation of the operable element in a first mode in which one of said bodies is moved or driven away from the alternate body on the GET being received with respect to said edge, the separation of the bodies operating to apply a force to said portion of the GET for holding the GET with respect to said edge, and a second mode in which one of said bodies is moved or driven toward the alternate body for removal of the GET.

[006A] According to a second aspect, there is provided an attachment assembly for releasably securing a ground engaging tool (GET) with earthmoving equipment, the attachment assembly comprising:

a first body configured for placement in affirmative engagement with a portion of or in fixed relation with respect to an edge of or associated with the earthmoving equipment;

a second body configured for placement in affirmative engagement with a portion of the GET;

an operable element operably associating the first and second bodies so as to be responsive to operation of the operable element in:

a first mode in which the second body is moved or driven away from the first body with the GET received with respect to said edge, the separation of the bodies operating to apply a force to said portion of the GET for holding the GET with respect to said edge, and

a second mode in which the second body is moved or driven toward the first body thereby releasing said force for removal of the GET,

wherein the second body comprises a slotted region and an opening by way of which a portion of or carried by the operable element is receiveable in the slotted region via one side of the second body for forming an engagement or interconnection between the second body and the operable element for enabling driving movement of the second body via operation of the operable element in the first and second modes.

[007] Embodiments of the above described aspects, and those describe below, may comprise, either individually or in combination, any of the following features.

[008] In one embodiment, said edge of or associated with the earthmoving equipment is a leading edge or a leading edge portion of a lip portion or lip component of or associated with an excavator bucket of the earthmoving equipment (eg. earthmoving vehicle). Said lip portion or lip component may comprise or be exemplified in the form of one or more plate and/or cast weld-on lip segments

formed for use with various types of excavator buckets used in various forms of ground engaging operations. In one form, such lip portion(s), lip component(s), or the or each plate and/or cast weld-on lip segment(s) are associated with the relevant excavator bucket by way of being connected therewith (eg. using any appropriate connection technique/process, eg. welding). In the present context, the leading edge or leading edge portion of the lip portion or lip component could be referred to as a wear edge. As such, for ease of explanation, reference to the leading edge or leading edge portion of the lip portion or lip component will be by way of the term 'wear edge'.

[009] In one embodiment, the GET comprises a body having a ground engaging region at a first end of the body. The body of the GET comprises a leg portion which extends away from the first end of the body and which is spaced from the body so as to define a first opening configured for snugly receiving a portion of the wear edge during fitment of the GET prior to operating of the attachment assembly in the first mode of operation for holding/securing the GET against the wear edge.

[0010] In one embodiment, the holding of the GET with the earthmoving equipment in the first mode of operation involves subjecting the GET to the force by way of the moving or driving of one of the bodies away from a distal extent of the leading edge while the alternate body remains in fixed relation relative to said distal extent so as to separate the bodies via operation _____

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of the operable element. In this manner, the force to which the GET is subject is in a direction away from the leading edge. In one form, the force to which the GET is subject is in a direction away from the leading edge substantially toward the earthmoving equipment.

[0011] In one embodiment, the removal of the GET in the second mode of operation involves reducing a force being applied to the GET for holding same against the wear edge by way of reducing the separation of the bodies via operation of the operable element.

[0012] In one embodiment, said portion of or in fixed relation with the wear edge is provided in the form of a boss arranged in fixed relation with an excavator bucket of the earthmoving equipment at or near the wear edge. In one form, the boss is welded in its position at or near the wear edge of the excavator bucket (but could be bolted in position or cast-in, for example).

[0013] In one embodiment, affirmative (or positive) engagement between the first body and the boss is by way of an interconnection between the first body and the boss.

[0014] In one embodiment, the first body is configured at or near a first end thereof so as to interconnect with the boss, the interconnection between the first body and the boss serving to place both in fixed relation with each other in at least one freedom of movement, for example, along a first axis running substantially parallel with an axis extending away from the wear edge or its distal extent.

[0015] In one embodiment, the first body is configured at or near a first end thereof so as to interconnect with the boss, the interconnection between the first body and the boss serving to place both in fixed relation with each other in a direction substantially orthogonal to the wear edge or its distal extent.

[0016] In one embodiment, the interconnection between the first body and the boss serves to place both in fixed relation with each other in two freedoms of movement, for example, the freedoms of movement being along the first axis and a second axis aligned substantially orthogonal with the first axis (for example, the second axis may run substantially parallel with the face of the wear edge or its distal extent).

[0017] In one embodiment, the interconnection between the first body and the boss serves to place both in fixed relation with each other in three freedoms of movement, for example, the

freedoms of movement being along the first, second axes and along a third axis aligned substantially orthogonal with the first and second axes.

[0018] In one embodiment, the first body comprises a hole opening to a surface provided at or near a second end of the body, the second end being opposite the first end of the body. The hole could be a blind hole or one that extends through the first body.

[0019] In one embodiment, a portion of the interior surface of the hole comprises a thread (for example, a female thread). In one form, said thread is provided or extends from at or near an inward disposed end of the hole of the first body.

[0020] In one embodiment, the operable element is rotatable about an axis of rotation. In one form, said axis of rotation is aligned substantially parallel with the first axis.

[0021] In one form, the operable element is of cylindrical form having an axis about which the operable element is movable or rotatable, whereby rotation of the operable element in one direction of rotation serves to enable operation of the first mode, and rotation in the alternate direction of rotation serves to enable operation of the second mode.

[0022] In one embodiment, the operable element comprises or is provided in the form of a piston having a head portion and a shaft portion extending from the head portion. The head portion is configured so as to be engageable with or by a driving tool, which engagement is operable for moving or rotating the operable element about its axis of rotation.

[0023] In one form, the hole has a thread configured for threaded engagement with a threaded portion provided with the shaft portion of the operable element.

[0024] In one embodiment, the head portion comprises a recess configured on an exterior facing surface of the head portion, the recess configured for engagement with or by a driving tool, the engagement between the recess and the driving tool configured operable for facilitating transfer of torque generated via the driving tool about the axis of rotation of the operable element thereby causing rotation of the operable element about the axis of rotation.

[0025] In one embodiment, a portion of an exterior of the shaft portion of the piston comprises a thread (for example, a male thread) compatible with the thread (for example, a female thread) of the hole so that the operable element can be arranged in threaded engagement

with the thread of the hole. In this manner, rotation of the piston about said axis of rotation moves or translates the piston along said axis of rotation.

[0026] In one embodiment, threaded engagement between the shaft portion of the piston of the operable element and the hole operably associates the first body with the operable element.

[0027] In one embodiment, the operable element comprises or carries an annular flange spaced along the shaft portion from the head portion. In one form, the annular flange positions intermediate the head portion and the threaded portion of the shaft portion. The engagement or interconnection between the operable element and the second body for enabling driving movement thereof being established by way of a portion of the annular flange being receivable in the slotted region of the second body.

[0028] In one embodiment, the second body comprises an opening extending between first and second oppositely disposed sides of the second body.

[0029] In one embodiment, the second body comprises the slotted region intermediate the first and second sides of the second body and which opens to the opening extending between first and second ends of the second body.

[0030] In another form, operable association of the first and second bodies via the operable element is by way of the threaded engagement of the hole with the operable element and the engagement or interconnection established by way of the receiving of the portion of the annular flange in the slotted region of the second body.

[0031] In one embodiment, the opening extending between first and second sides of the second body is configured so as to receive or accommodate a portion of the shaft portion of the piston of the operable element.

[0032] In one embodiment, the slotted region is configured so as to receive/accommodate at least one or more portions (eg.one or more shoulder portions of the annular flange) of the annular flange sufficient for capturing the or each portion of the annular flange therein for confirming an/the engagement or interconnection between the second body and the operable element. Engagement of the annular flange with the slotted region in this manner operably associates (via movement/translation of the piston) the operable element with the second body such that

movement of the annular flange facilitates movement or driving of the second body on operation of the operable element. In this manner, rotation of the operable element about its axis of rotation causes the annular flange to move or translate along said axis of rotation. The direction of rotation of the operable element about the axis of rotation informs the direction along the axis the annular flange moves or translates (and moves/drives the second body).

[0033] In one form, the second body is configured so as to increase or maximise the portion of the annular flange received or accommodated within the slotted region. In one form, such configuration may enable the slotted region to receive or accommodate a portion of the shaft portion which comprises or carries the annular flange so as to increase or maximise the portion of same within the slotted region.

[0034] In one embodiment, operable association of the first and second bodies via the operable element is by way of the threaded engagement of the hole with the shaft portion of the operable element, and the interconnection established by way of the receiving of the portion(s) of the annular flange in the slotted region of the second body. In this manner, the operable element operably associates the first body with the second body.

[0035] In one embodiment, movement or translation of the operable element along the axis about which it rotates (on operation of the operable element) enables the annular flange to push against the second body by way of the interconnection established by way of the receiving of the portion(s) of the annular flange in the slotted region of the second body.

[0036] In one embodiment, the second body is configured having one or more portions thereof that interact with or bear against one or more portions of the GET so that it follows or is driven by movement of the second body (for example, by way of the second body pushing against a portion of the GET) in either of the first, second modes of operation in response to operation of the operable element (eg. when caused to be operable about the axis of rotation by way of the drive tool when engaged with the recess of the head portion). In this manner, the second body is affirmatively engaged with at least one portion of the GET. In one form, the second body is positioned relative to the GET so that one or more portions of the second body bear against one or more portions of the GET so as to positively drive or move, or seek to positively drive or move, the GET on operation of the operable element via the driving tool.

[0037] In one form, the operable element carries or is operable with one or more annular seal elements arranged concentric with or carried by the shaft portion, the or each seal element positionable relative the shaft portion so as to protect one or more regions of thread or of threaded engagement from ingress of debris during ground engaging operations.

[0038] In one embodiment, driving or moving of the GET on operation of the operable element occurs in respect of an axis which is aligned substantially parallel with the first axis in either of first, second directions there along.

[0039] In one embodiment, one or more portions of the second body interact with one or more portions of the GET by pushing there against for seeking to move/drive same in substantially the first direction in the first mode of operation of the attachment assembly.

[0040] In one embodiment, one or more portions of the second body interact with one or more portions of the GET by pushing there against for seeking to move/drive same in substantially the second direction in the second mode of operation of the attachment assembly.

[0041] In the first mode of operation, moving/driving of the GET by the second body in the first direction substantially aligned with the first axis on operation of the operable element about the axis of rotation in a first direction of rotation operates to subject the GET to a force for progressing or converging the GET toward a position in which the GET is held or secured against the wear edge.

[0042] In the second mode of operation, moving or driving of the GET by the second body in the second direction substantially aligned with the first axis on operation of the operable element about the axis of rotation in a second direction of rotation, substantially opposite to the first direction of rotation, operates to reduce, disrupt or release a force causing the GET to remain in said position against the wear edge.

[0043] In one embodiment, operation of the operable element in the second mode of operation positively moves or drives the GET away from said position in which the GET is held against the wear edge or its distal extent.

[0044] In an alternate embodiment, the operable element is rotatably supported in the hole in a manner allowing it freedom to rotate about said axis of rotation, but without freedom to translate along said axis of rotation. In this arrangement, the second body is configured so as to threadedly engage with a portion (eg. a threaded portion of the shaft of the piston) of the operable element such that rotation of the operable element, about its axis of rotation, causes the second body to translate along a portion of the operable element for seeking to increase

the spacing between the first, second bodies, or reduce same as required depending on which of the first, second modes is operable.

[0045] In one embodiment, the GET comprises a second opening in a side thereof (for example, a side of the GET that is upward facing relative to its installation orientation with the excavator bucket) and through or into which the second body is inserted/placed for positioning relative thereto such that one or more portions of the second body interact with one or more portions of the GET for driving or moving of same in the first, second modes of operation via selective operation of the operable element.

[0046] In one embodiment, the GET comprises a second opening in a side thereof and through or into which the second body is insertable/placeable for engaging or interconnecting the slotted region with the annular flange and positioning the second body relative to the GET so as to enable said portion(s) of the second body to interact with or bear against said respective corresponding portion(s) of the GET for driving or moving of same in the first, second modes of operation via operation of the operable element.

[0047] The assembly may further comprise, or be arranged operable with, a retention means, device, or system (*hereinafter*, retention means/device) operable between a portion of the second body and a portion of the GET or the operable element for establishing mutual engagement or interaction that is operable for retaining or preserving the position of the second body relative to the GET following insertion/placement of the second body through or into the second opening.

[0048] The retention means/device may be attachable with the second body and comprise one or more portions engageable with one or more respective corresponding portions of the GET/shroud by way of, at least in part, a resilient characteristic of the retention means/device following insertion of the second body through or into the second opening into position relative to the GET/shroud (for driving or moving of same).

[0049] The retention means/device may be attachable with the GET/shroud and comprise one or more portions engageable with one or more respective corresponding portions of the second body by way of, at least in part, a resilient characteristic of the retention means/device following insertion of the second body through or into the second opening into position relative to the GET/shroud (for driving or moving of same).

[0050] The retention means/device may be configured operable between a portion of the second body and a portion of the operable element for establishing an engagement or interaction between both that is operable for retaining or preserving the position of the second body relative to the GET following insertion of the second body through or into the second opening into position relative to the GET/shroud (for driving or moving of same).

[0051] The retention means or device may comprise:

(i) a metallic material, or

(ii) an elastomeric material, or

(iii) a combination of both a metallic material and an elastomeric material.

[0052] For the case where one or more portions or components of the retention means/device comprises, either individually or in combination, an elastomeric component (for example, a rubber material, vulcanized or otherwise), the elastomeric portion or component may be configured, whether attached with the second body or the GET/shroud, so as to be sufficiently compressible or elastically deformable so as to allow for insertion of the second body through the second opening into a position relative to the GET/shroud for driving or moving of same, and transitionable to a condition that operates directly or indirectly with the GET/shroud, second body, or the operable element to impede the second body from lifting upwards out of its position relative to the GET/shroud thereby preserving said relative position.

[0053] For the case where one or more portions or components of the retention means/device comprises, either individually or in combination, a metallic component, the metallic portion or component may be formed or configured (for example, in a spring-like manner), whether attached with the second body or the GET/shroud, so as to be sufficiently compressible or elastically deformable so as to allow for insertion of the second body through the second opening into a position relative to the GET/shroud for driving or moving of same, and transitionable to a condition that operates directly or indirectly with the GET/shroud, second body, or the operable element to impede the second body from lifting upwards out of its position relative to the GET/shroud thereby preserving said relative position.

[0054] The retention means or device may be attachable to either the second body or the GET/shroud by way of any of the following: an adhesive bond, a vulcanisation bonding process.

[0055] In one embodiment, a profile or shape of the second opening of the GET is substantially complementary with a profile or shape of at least one side of or aspect of the second body, the complementary nature of the profile/shape of the second opening and the profile/shape of the at least one side or aspect of the second body enabling the second body to be insertable through the second opening for said relative positioning of the second body with the GET thereby operating to establish, at least in part, the affirmative (or positive) interconnection/engagement between both components when the second body is placed within the second opening. In this manner, the second body is able to push against a portion of the GET when the second body is moved/driven by the operable element via the annular flange.

[0056] In one embodiment, the GET comprises a third opening in a side thereof configured so as to allow access to the operable element or its head portion for operation thereof via a driving tool.

[0057] In one embodiment, the second body comprises one or more further slots formed in respective one or more sides of the second body, the or each slot configured for receiving a portion of a tool for use in removal of the second body (via, for example, the second opening).

[0058] In one embodiment, the or each further slots are of finite depth having a respective opening.

[0059] In one embodiment, one or more edges of the second opening of the GET are configured or shaped so as to expose, at least in part, one or more of the further slots formed in the sides of the second body when both components are in affirmative engagement.

[0060] In one embodiment, the or each edges of the second opening of the GET are configured having a sloped or inclined surface (hereinafter, inclined surface(s)) that terminates at or near an opening of one of said further slots when the second body is positioned relative to the GET for operation with the remaining componentry of the attachment assembly in one or both of the first, second modes of operation.

[0061] In one embodiment, the or each inclined surface allows access to an adjacently disposed further slot so that a tool (such as for example, a crowbar) can be used to engage the relevant further slot for prising/leveraging of the second body from the second opening of the GET.

[0062] In one embodiment, the first, second bodies and the operable element are substantially operable within a profile of the GET.

[0063] In one embodiment, at least the first body and the operable element are operable with a channel formed within the GET which opens to adjacent sides of the GET or its body.

[0064] In one embodiment, the channel is configured for receiving the boss when the GET is being positioned relative to or in respect of the wear edge for securement thereto. In one form of assembly, at least the first body (which may be assembled with the operable element) is first interconnected with the boss, and the GET fitted in position relative to the wear edge (or its distal extent) for securement. Thus, in at least one embodiment, the channel is configured so as to be substantially parallel with/to a longitudinal extent of the GET and operable for receiving both the boss and the first body when the GET is being positioned relative to the wear edge. The channel may be configured so as to be complementary in shape to the effective shaping/profile of the boss and the first body (either individually, or in combination) when in their affirmative/interconnected engagement such that both can be snugly received and retained in the channel when the GET is in position such that the GET is restricted to move relative to the boss and the first body along a length of the channel. For example, the boss and the first body may be configured having tapering sidewalls (for example, of a 'dove-tail' or 'T' like shape/configuration) so that as the channel slides over the boss and the first body and the GET self-centres and self-aligns with respect to the boss (and the interconnected first body). Such interaction, advantageously, enhances the fit of the GET with respect to the wear edge and or its distal extent.

[0065] Of course, embodiments can be realised where the operability described above may only be required in respect of the boss itself, for example, where the first body, while interconnected with the boss, has a smaller profile and does not warrant shaping for interacting with the channel.

[0066] When fitting the GET to the wear edge, the channel is positioned relative to the boss and the first body so that the GET can be slidingly received there over, and the wear edge is received in the first opening. The channel may commence a distance from an end of the GET distal of the ground engaging region of the GET, and extend towards said ground engaging region and terminating a distance therefrom.

[0067] In one embodiment, the channel opens to the first, second, and third openings of the GET.

[0068] In one embodiment, one or more portions of a surface of the boss and/or the first body is/are configured so that interaction with one or more portions of a surface of the GET operates to assist in guiding or converging the GET toward a position in which said GET is held with respect to the wear edge when the operable element is operated in the first mode of operation.

[0069] In one embodiment, one or more portions of respective sides of the first body and/or the boss are shaped so as to interact with one or more portions of an interior surface of the channel of the GET, such interaction being configured for, at the least, assisting in guiding or converging of the GET toward a position in which it is held against the wear edge by operation of the attachment assembly in the first mode of operation.

[0070] In one embodiment, one or more portions of respective sides of the first body and/or the boss are shaped so as to cooperate by way of interacting with one or more portions of an interior surface of the channel of the GET, such interaction being configured for, at the least, assisting in guiding or converging the GET toward a position in which it is held against the wear edge by operation of the attachment assembly in the first mode of operation.

[0071] In one embodiment, said interaction between the or each respective side portion(s) of the first body and/or boss and interior portion(s) of the channel of the GET operate to substantially restrain the GET in the first, second, and third axes relative to the wear edge and or its distal extent.

[0072] In one embodiment, one or more respective sides of the first body are shaped/configured so as to substantially continue the form or profile of the boss for assisting in guiding the GET toward a position in which it is held against the wear edge by operation of the attachment assembly in the first mode of operation.

[0073] According to a third aspect, there is provided a ground engaging assembly for use with a leading or wear edge of or associated with earthmoving equipment, the ground engaging assembly comprising:

a ground engaging tool (GET) configured to be received with respect to said edge, the GET configured having a channel for receiving a portion of or in fixed relation with

respect to said edge when the GET is being positioned relative to said edge for securement thereto,

an attachment assembly for releasably securing the GET with said edge, the attachment assembly comprising:

a first body configured for placement in affirmative engagement with said portion of or in fixed relation with respect to said edge;

a second body configured for placement in affirmative engagement with a portion of the GET;

an operable element operably associating the first and second bodies so as to be responsive to operation of the operable element in a mode in which one of said bodies is moved or driven away from the alternate body, the separation of the bodies operating to apply a force to said portion of the GET for holding the GET with respect to said edge, and in a further mode in which one of said bodies is moved or driven toward the alternate body for removal of the GET.

[0074] According to a fourth aspect, there is provided a ground engaging assembly for use with a leading or wear edge of or associated with earthmoving machinery, the ground engaging assembly comprising:

a member associable at or near said edge so as to be in fixed relation therewith,

a ground engaging tool (GET) configured to be received with respect to said edge, the GET configured having a channel for receiving said member when the GET is being positioned relative to said edge for securement thereto,

an attachment assembly for releasably securing the GET with said edge, the attachment assembly comprising:

a first body configured for placement in affirmative engagement with said member;

a second body configured for placement in affirmative engagement with a portion of the GET;

an operable element operably associating the first and second bodies so as to be responsive to operation of the operable element in a mode in which one of said bodies is moved or driven away from the alternate body, the separation of the bodies operating to apply a force to said portion of the GET for holding the GET with respect to said edge, and in a further mode in which one of said bodies is moved or driven toward the alternate body for removal of the GET.

[0075] According to a fifth aspect, there is provided a method of attaching a ground engaging tool (GET) with a leading or wear edge of or associated with earthmoving equipment, the method comprising:

forming, providing or configuring a GET so as to be receivable with respect to said edge, the GET configured having a channel for receiving a portion of or in fixed relation with respect to said edge when the GET is being positioned relative to said edge for securement thereto,

forming, providing or configuring an attachment assembly for releasably securing the GET with said edge, the attachment assembly comprising:

a first body configured for placement in affirmative engagement with said portion of or in fixed relation with respect to said edge;

a second body configured for placement in affirmative engagement with a portion of the GET;

an operable element operably associating the first and second bodies so as to be responsive to operation of the operable element in a mode in which one of said bodies is moved or driven away from the alternate body,

arranging the first body in operable association with the operable element, and in affirmative engagement with said portion of or in fixed relation with respect to said edge,

arranging the second body in operable association with the operable element, and in affirmative engagement with said portion of the GET,

operating the operable element so as to separate the bodies for applying a force to the GET for holding same with respect to said edge.

[0076] According to a sixth aspect, there is provided a method of releasing a ground engaging tool (GET) secured with a leading or wear edge of or associated with earthmoving equipment by way of a force being applied to the GET by way of an attachment assembly comprising a first body in affirmative engagement with respect to said edge, a second body in affirmative engagement with the GET, and an operable element operably associating the first and second bodies so as to be in spaced or separated relation for providing said force, the method comprising operating the operable element so as to reduce said spaced or separated relation of the bodies for reducing said force for removal of the GET.

[0077] In one embodiment, the operable element and the first, second bodies are components of an embodiment of an attachment assembly according substantially with the attachment assembly of the first or second aspects, or as otherwise described herein.

[0078] According to a seventh aspect, there is provided a method of forming or configuring an embodiment of an attachment assembly as described herein.

[0079] According to an eighth aspect, there is provided a method of forming or configuring an embodiment of a ground engaging assembly as described herein

[0080] According to a ninth aspect, there is provided a method of using an embodiment of an attachment assembly as described herein for releasably securing a ground engaging tool with earthmoving equipment, and or removing a ground engaging tool from earthmoving equipment.

[0081] According to a further aspect, there is provided an attachment assembly for releasably securing a ground engaging tool (GET) with earthmoving equipment, the attachment assembly comprising:

a first body configured for placement in affirmative engagement with a portion of or in fixed relation with respect to an edge of or associated with the earthmoving equipment;

a second body configured for placement in affirmative engagement with a portion of the GET;

an operable element operably associating the first and second bodies so as to be responsive to operation of the operable element in:

a first mode in which the second body is moved or driven away from the first body with the GET received with respect to said edge, the separation of the bodies operating to apply a force to said portion of the GET for holding the GET with respect to said edge, and

a second mode in which the second body is moved or driven toward the first body thereby releasing said force for removal of the GET,

wherein the second body comprises a slotted region configured so as to receive a portion of or carried by the operable element for forming an engagement or interconnection therebetween for enabling driving movement of the second body via operation of the operable element in the first and second modes.

[0082] According to another aspect, there is provided a method of attaching a ground engaging tool (GET) with a leading or wear edge of or associated with earthmoving equipment, the method comprising:

forming, providing or configuring an attachment assembly in accordance with any embodiment of an attachment assembly as described herein for releasably securing the GET with said edge,

arranging the first body in operable association with the operable element, and in affirmative engagement with said portion of or in fixed relation with respect to said edge,

positioning the GET in respect of said edge such that a portion thereof receives said portion of or in fixed relation to said edge,

arranging the second body in operable association with the operable element and in affirmative engagement with said portion of the GET,

operating the operable element so as to separate the bodies for applying a force to the GET for holding same with respect to said edge.

[0083] According to a further aspect, there is provided a ground engaging system or tool operably configured in accordance with any embodiment of a ground engaging assembly or ground engaging tool described herein.

[0084] According to another aspect, there is provided an excavator bucket or wear like component of an earthmoving equipment/vehicle having, or configured for operable use with, an embodiment of an attachment assembly, a ground engaging system or assembly, or a ground engaging tool arranged in accordance with any embodiment of an attachment assembly, a ground engaging system or assembly, or a ground engaging tool as described herein.

[0085] According to a further aspect, there is provided an earthmoving equipment/vehicle having, or configured for operable use with, an embodiment of a ground engaging assembly arranged in accordance with the ground engaging assembly as described herein.

[0086] According to a further aspect, there is provided a kit of parts comprising any of the components of any embodiment of the attachment assembly as described herein, either individually or in combination.

[0087] In one form, the kit comprises an embodiment of a boss as described herein for attachment to at or near a leading or wear edge of an earthmoving equipment/vehicle.

[0088] According to another aspect, there is provided a kit of parts comprising any of the components of an embodiment of a ground engaging system, related assembly, or related tool arranged in accordance with the ground engaging system, related assembly, or related tool as described herein, either individually or in combination.

[0089] Embodiments of the attachment assembly described herein may provide any of the following advantages:

- a simplified 'vice' like attachment assembly (one fixed body/jaw captured in a boss associated with the bucket of the earth moving equipment, and one movable body/jaw traversably captured in the shroud or body of the GET) that can be used to facilitate both retightening of the GET on or in respect of the leading or wear edge, as well as helping expel it once worn for replacement purposes;
- an attachment assembly that combines the utility of the interaction between a boss and the GET which helps limit the stresses induced on the components of the attachment assembly, with the utility of a thread type locking/retention system. In some instances, a means, device, or arrangement for preventing or at least limiting turning of such systems (eg. an anti-turn means or element) may be employed for redundancy measures; for example a means, device, or arrangement can be configured operable with the thread of the threaded portion of the operable element so as to cooperate with the thread so as to seek to reduce, to the extent possible, any "play" that might develop between the operable element and the hole (blind or otherwise) when operable. In this regard, such cooperability operates, at least in part, as a means of conferring/facilitating additional friction for keeping the operable element in its intended position and limit its tendency to work itself free (due to any "backlash" that might be experienced) during on-going loading cycles during ground engaging operations;
- enhanced protection of the attachment assembly from wear and fines as compared existing solutions;
- easy/convenient visualisation and accessibility of the moving body/jaw to permit easy and safe installation and removal of the shroud or body of the GET;
- one or more failsafe release points should the thread of the lock seize up making extraction difficult/stubborn. In this manner, access is provided at about the region where the second body inserts via the second opening so that, in the event that, for example, the thread of the operable element seizes up making a removal operation more challenging/difficult, access is provided/enabled for allowing a cutting means (such as for example, a grinding blade or oxy gas torch flame) to be used to severe the shaft of the operable element for facilitating easier removal of the operable element

and the second body from within the shroud or body of the GET, for example, the cutting/severing process resulting in a portion of the length (eg. about 3-5mm) of the operable element (eg. its shaft portion) being eliminated so as to generate enough clearance or play so that both the operable element and the second body can be manipulated from within the confines of the body or shroud of the GET;

- simplified manufacturing of components of the attachment assembly, as a whole, when compared to existing attachment/locking systems;
- simplified core boxes for castings, reduced number and intricacy of locking components.

[0090] Various aspects described herein can be practiced alone or combination with one or more of the other aspects, as will be readily appreciated by those skilled in the relevant art. The various aspects can optionally be provided in combination with one or more of the optional features described in relation to the other aspects. Furthermore, optional features described in relation to one example (or embodiment) can optionally be combined alone or together with other features in different examples or embodiments.

[0091] For the purposes of summarising the aspects, certain aspects, advantages and novel features have been described herein above. It is to be understood, however, that not necessarily all such advantages may be achieved in accordance with any particular embodiment or carried out in a manner that achieves or optimises one advantage or group of advantages as taught herein without necessarily achieving other advantages as may be taught or suggested herein.

[0092] It is to be understood that each document, reference, patent application or patent cited in this text is expressly incorporated herein in their entirety by reference, which means that it should be read and considered by the reader as part of this text. That the document, reference, patent application, or patent cited in this text is not repeated herein is merely for reasons of conciseness.

[0093] Furthermore, in this specification, where a literary work, act or item of knowledge (or combinations thereof), is discussed, such reference is not an acknowledgment or admission that any of the information referred to formed part of the common general knowledge as at the priority date of the application. Such information is included only for the purposes of providing context for facilitating an understanding of the inventive concept/principles and the various forms or embodiments in which those inventive concept/principles is/are exemplified.

Summary of Drawings

[0094] In order to provide a better understanding of the present invention, a preferred embodiment will now be described in detail, by way of example only, with reference to the accompanying drawings:

[0095] **Figure 1** shows a perspective view of a bucket of an earth moving equipment/vehicle having a plurality of ground engaging tools (GETs) connected at/near its lower (leading) edge;

[0096] **Figure 2** shows a perspective view of a corner region of an edge of a bucket of an earthmoving equipment/vehicle, to which is provided a GET (one suited for placement at/about a corner region of the edge) retained in position using one embodiment of an attachment assembly arranged in accordance with the principles described herein;

[0097] **Figure 3** shows a further perspective view of that shown in **Figure 2**, with the GET and attachment assembly removed;

[0098] **Figure 4** shows an end view of that shown in **Figure 3**;

[0099] **Figure 5** shows a perspective view of the embodiment of the attachment assembly shown in **Figure 2** to **4**, with the GET and bucket removed;

[00100] **Figure 6** shows an exploded perspective view of that shown in **Figure 5**;

[00101] **Figure 7A** shows a part exploded perspective view of that shown in **Figure 6**;

[00102] **Figure 7B** shows a perspective view of another embodiment of the operable element shown in **Figure 7A;**

[00103] **Figure 8** shows a perspective view of the parts shown in **Figures 5** to **7A** in an assembled condition;

[00104] **Figure 9** shows a perspective view of the assembled components shown in **Figure 8**, in-situ with the bucket of the relevant earth moving equipment/vehicle (with the GET omitted);

[00105] **Figure 10** shows an alternate perspective view with the GET about to be secured with the bucket of the earth moving equipment/vehicle;

[00106] **Figure 11** shows an advancement of that shown in **Figure 10** in the process of securing the GET with the bucket of the earth moving equipment/vehicle;

[00107] **Figure 12** shows an advancement of that shown in **Figure 11** in the process of securing the GET with the bucket of the earth moving equipment/vehicle;

[00108] **Figure 13** shows an advancement of that shown in **Figure 12** in the process of securing the GET with the bucket of the earth moving equipment/vehicle;

[00109] **Figure 14** shows a cross-section view showing an advancement of that shown in **Figure 13** in the process of securing the GET with the bucket of the earth moving equipment/vehicle, indicating the operation of the attachment assembly in securing the moving equipment/vehicle in position;

[00110] **Figure 15** shows a further close up perspective view of the GET secured in position;

[00111] **Figure 16** shows a perspective view of another embodiment of an attachment assembly arranged in accordance with the principles described herein;

[00112] **Figure 17** shows a perspective exploded view of the embodiment of the attachment assembly shown in **Figure 16**;

[00113] **Figure 18** shows a perspective view of an assembled version of the embodiment of the attachment assembly shown in **Figure 17** being placed in position for use in securing the GET with the bucket of the earth moving equipment/vehicle;

[00114] **Figure 19** shows an advancement of that shown in **Figure 18**; and

[00115] **Figure 20** shows a cross-section view of the embodiment shown in **Figures 16** to **19**, analogous to that shown in **Figure 14**;

[00116] **Figure 21** shows an exploded perspective view of an embodiment which exemplifies a variation of the embodiment shown in **Figures 16** to **20** (with GET removed);

[00117] **Figure 22** shows an elevation view of an advancement of that shown in **Figure 21** in an assembly process (with GET removed);

[00118] **Figure 23** shows an elevation view of a further advancement of that shown in **Figure 22** (with GET removed).

[00119] **Figure 24** shows a perspective view of one embodiment of the moveable jaw, formed in accordance with the principles described herein, in which the moveable jaw is provided with a retainer element;

[00120] **Figure 25** shows a side view of the embodiment of the moveable jaw and retainer element shown in **Figure 24**;

[00121] **Figure 26** shows one embodiment of a retention means or device operable with a form of the attachment assembly described and shown herein, showing a cut-away cross-section perspective view of the embodiment of the moveable jaw (**35**) and a retainer element (**100**) shown in **Figures 24** and **25**, with the moveable jaw having been inserted through the opening (**37**) of the shroud (**17**) and the retainer element engaged with portions of the shroud so as to mitigate against a risk of the moveable jaw becoming dislodged**;**

[00122] **Figure 27** shows an aspect (in direction $\mathbf{V_R}$ identified in **Figures 28** and **29**) of the shroud (**17**) when viewed from behind (or toward the front of the bucket) the shroud with other potential locations for engagement between the retainer element (**100**) and internal regions of the shroud being identified;

[00123] **Figure 28** shows a cut-away perspective view of region **A1** shown in **Figure 27**, showing an example of an engagement between a retaining element carried by the moveable jaw (**35**) and a portion of the interior surface of the shroud (**17**); and

[00124] **Figure 29** shows a perspective view of the shroud (**17**) with the moveable jaw (**35**) having been inserted through the opening (**37**), and identifying other potential regions where retention means, devices, systems can be engineered to be established.

[00125] In the figures, like elements are referred to by like numerals throughout the views provided. The skilled reader will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions and/or relative positioning of some of the elements in the figures may be exaggerated relative to other elements to facilitate an understanding of the various embodiments exemplifying the principles described herein. Also, common but well understood elements that are useful or necessary in a commercially feasible embodiment are often not depicted in order to provide a less obstructed view of these various embodiments. It will also be understood that the terms and expressions used herein adopt the ordinary meaning as is accorded to such terms and expressions with respect to their corresponding respective areas of inquiry and study except where specific meanings have otherwise been set forth herein.

[00126] It should be noted that the figures are schematic only and the location and disposition of the components can vary according to the particular arrangements of the embodiment(s) as well as of the particular applications of such embodiment(s).

[00127] Specifically, reference to positional descriptions, such as 'lower' and 'upper', and associated forms such as 'uppermost' and 'lowermost', are to be taken in context of the embodiments shown in the figures, and are not to be taken as limiting the scope of the principles described herein to the literal interpretation of the term, but rather as would be understood by the skilled reader.

[00128] Embodiments described herein may include one or more range of values (eg. size, displacement and field strength etc). A range of values will be understood to include all values within the range, including the values defining the range, and values adjacent to the range which lead to the same or substantially the same outcome as the values immediately adjacent to that value which defines the boundary to the range.

[00129] Other definitions for selected terms used herein may be found within the detailed description and apply throughout. Unless otherwise defined, all other scientific and technical terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which the embodiment(s) relate.

Detailed Description of Embodiments

[00130] The words used in the specification are words of description rather than limitation, and it is to be understood that various changes may be made without departing from the spirit and scope of any aspect of the invention. Those skilled in the art will readily appreciate that a wide variety of modifications, alterations, and combinations can be made with respect to the above described embodiments without departing from the spirit and scope of any aspect of the invention, and that such modifications, alterations, and combinations are to be viewed as falling within the ambit of the inventive concept.

[00131] Throughout the specification and the claims that follow, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

[00132] Furthermore, throughout the specification and the claims that follow, unless the context requires otherwise, the word "include" or variations such as "includes" or "including", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

[00133] **Figure 1** shows a lip portion or component **2** (*hereinafter*, lip portion) of an excavator bucket **5** of an instance of an earthmoving equipment/vehicle (not shown in the figures). The lip portion **2** may comprise, for example, of a configuration of one or more plate and/or cast weld-on lip segments formed for use with various types of excavator buckets used in various forms of ground engaging operations. As better seen in **Figure 2**, the lip portion **2** comprises a leading or wear edge portion (*hereinafter*, edge portion **10**) to which a plurality of ground engaging tools (***GET***s) (collectively, **15**) are connected by way of being held against a landing face **11** and the edge portion (the landing face **11** being a distal extent of the lip portion **2** following a tapered transition thereto). **Figure 1** shows a version of a GET configured for attachment between the corners of the edge portion **10**, and a version of a GET $\mathbf{15_C}$ which is configured for attachment at respective corner regions of the edge portion.

[00134] **Figures 2** to **15** show one embodiment of an attachment assembly **25** used, in one form, in a GET assembly for releasably attaching a GET $\mathbf{15_C}$ to the edge portion **10**. **Figure 2** shows the GET $\mathbf{15_C}$ (with the alternate configuration of the GETs **15** omitted for clarity)

secured in position against the edge portion **10** following operation of the attachment assembly **25**.

[00135] As the skilled reader will appreciate, the form of the GETs **15** shown throughout the accompanying figures comprise respective shrouds **17**. However, other forms of GETs used for mining operations may not comprise a shroud, and may instead comprise a substantially equivalent component that can still benefit from the principles described herein, or be configured so as to operate with them. Thus, the present description, and the principles outlined herein, is/are not to be limited to their use or application to GETs as shown and described herein but can be applied for use by any form of GET requiring removable attachment to an overarching ground engaging device or mechanism.

[00136] The shroud **17** comprises a body having a ground engaging region $\mathbf{17_{G\text{-}E}}$ at a first end $\mathbf{17_1}$ of the body $\mathbf{17_B}$. The shroud **17** comprises a leg portion $\mathbf{17_L}$ which extends away from the first end $\mathbf{17_1}$ of the body $\mathbf{17_B}$ and which is spaced from the body so as to define a first opening **78** configured for snugly receiving a portion of the edge portion **10** during fitment of the shroud **17** prior to operating of the attachment assembly **25** in the first mode of operation for holding/securing the shroud **17** against the edge portion **10**.

[00137] The attachment assembly **25** comprises a first body (*hereinafter*, fixed jaw **30**) configured for being placed in affirmative or positive engagement with a boss **32** which is attached usually by way of a suitable welding process with the edge portion **10** (as shown in **Figures 3** and **4**) of the earthmoving machine. As the skilled reader will appreciate, a plurality of bosses **32** are provided spaced from each other along the edge portion **10** of the bucket **5**, with each used in the connection of a respective GET with the bucket (only one boss **32** is shown in the Figures for clarity of explanation).

[00138] As clearly seen in **Figures 3** and **4**, the boss **32** is configured having a shaped exterior providing corresponding tapering or 'dovetail' shaped sides/shoulders $\mathbf{29_A}$, $\mathbf{29_B}$ which engage with corresponding interior surface portions of a channel **38** (which is shown in a cross-section view in **Figure 14**) formed with the shroud **17** of the GET $\mathbf{15_C}$. The channel **38** is formed in a portion **22** with positions adjacent the upper facing surface of the edge portion **10** of the bucket **5**, and which opens to adjacently disposed sides **23** (eg. underside side, more clearly seen in **Figure 10**), **24** (trailing or rearward side) of the shroud **17**.

[00139] The shroud **17** of the GET **15c** comprises an opening **78** (as shown in **Figure 10**) which is configured to receive the edge portion **10** of the bucket **5** during assembly of the GET **15c** with the bucket. Receiving of the edge portion **10** in the opening **78** serves to place the shroud **17** and the bucket in an abutting relationship when the GET **15c** is to be attached therewith.

[00140] As seen in **Figure 5**, the fixed jaw **30** is placed in affirmative engagement with the boss **32** by way of an end **31** of the fixed jaw **30** being shaped/configured so as to interconnect with an end **33** of the boss **32**. As seen clearly in **Figures 5**, **6**, **7**, and **8**, the fixed jaw **30** is substantially 'H' shaped, whereby the end **31** is substantially 'T' shaped so as to slot into position with arm portions **45**, **47** (see **Figure 5**) provided at the end **33** of the boss **32**. As the skilled reader would appreciate, the interconnection of the fixed jaw **30** with the boss **32** serves to fix the fixed jaw **30** relative to the edge portion **10** of the bucket **5** (and, indeed, the landing face **11**) in three orthogonally aligned freedoms of movement: axis **L** (**l**ongitudinal axis relative to the earthmoving equipment/vehicle), axis **W** (**w**idth axis relative to the earthmoving equipment/vehicle), and axis **H** (**h**eight axis relative to the earthmoving equipment/vehicle), as shown in **Figure 1**. For the present description, the axis **W** aligns substantially with the landing face **11** (as shown in **Figures 1-4**) thereby defining the origin of the axes **L** and **H**, with axis **L** increasing toward the interior region of the bucket **5**, and height **H** increasing vertically in the usual manner.

[00141] The skilled reader will readily appreciate that the ends **31**, **33** of the respective fixed jaw **30** and boss **32** could be configured in various manners that would allow interacting portions of both the fixed jaw **30** and the boss **32** to be interconnectable with one another for establishing the required constraint for the fixed jaw **30**.

[00142] The fixed jaw **30** comprises a blind hole **43** formed in a face **44** provided at a terminal end **46** of the fixed jaw, as shown in **Figure 7A**. A portion of the interior surface of the blind hole **43** (at or near the inward most end of the blind hole) is provided with a thread (a female thread for the embodiment described) that is threadedly engageable with a thread provided on a portion of the operable element **40** (a male thread for the embodiment described). It will be appreciated that the blind hole **43** need not be blind, but could extend through the fixed jaw **30** if required. Thus, while a blind hole (**43**) is used in the embodiment described herein, the skilled reader will appreciate that all that is required is a circular recess extending into the fixed jaw **30** and configured capable of carrying a thread that is engageable with a corresponding

thread provided on a portion **49** of the exterior surface of the shaft portion **59** of the operable element **40**, as will be described below.

[00143] The attachment assembly **25** further comprises a second body (*hereinafter*, moveable jaw **35**) configured for being placed in affirmative or positive engagement with a portion of the GET **15c**.

[00144] The moveable jaw **35** is configured so as to slot into an upper opening **37** (comprising a large size rectangular space **37A** and a smaller sized rectangular space **37B** – better seen in **Figures 15** and **28**) which opens to the channel **38** that is formed near an end **39** of the shroud **17** (the placement of the moveable jaw **35** into the upper opening **37** is shown in **Figures 12** and **13**, with the moveable jaw moveable in direction **S** so as to slot in position within the upper opening **37**). The moveable jaw **35** is configured having a general rectangular profile which is complementary with the profile of the upper opening **37** so that the moveable jaw **35** can be received in the upper opening such that portions of the shroud **17** (which, in part, define the upper opening **37**) and the moveable jaw **35** interact with one another for facilitating the affirmative engagement between the moveable jaw **35** and the shroud **17**. The interaction between the moveable jaw **35** and the shroud **17** applies a force (by the moveable jaw **35** pushing against the shroud **17**) to the shroud by movement of the moveable jaw **35** seeking to move or drive the shroud in the direction of the applied force along the axis **M** (ie. increasing in axis **L** relative to the landing face **11**).

[00145] Of course, as noted above with regard to the interconnection between the fixed jaw **30** and the boss **32**, respective interacting portions can be shaped/configured in various manners that would allow both components to be interconnectable with one another.

[00146] With reference to **Figures 6** and **7A**, the operable element **40** is generally of a piston like form, and rotatable and translatable about/along an axis **M**.

[00147] The piston like form of the operable element **40** comprises a shaft portion **59** extending from a head portion **60**. The head portion **60** provides a recess (*hereinafter*, drive cavity **62**) of polygonal form (eg. square shaping shown) formed within an end face **63**. Spaced inward of the head portion **60** and extending radially from the shaft portion **59** is an annular flange **64** which is configured of sufficient form so as to be received within a slotted region (the slot **61**, as described below) formed in the moveable jaw **35** when the moveable jaw is inserted into the upper opening **37** of the shroud **17**. The engagement between the slot

61 and the annular flange **64** establishes affirmative engagement between the operable element **40** and the moveable jaw **35** (in the manner shown in **Figure 7A**), as will be described below.

[00148] A portion **49** of the exterior surface of the shaft portion **59** of the operable element **40** is provided with a male thread which is formed so as to be threadedly engageable with the female thread of the blind hole **43**.

[00149] As shown in **Figure 6**, the moveable jaw **35** comprises an opening **50** (reminiscent of an arch like form) which extends between first **52** and second **54** opposite sides of the moveable jaw for defining leg portions **56**, **58**. The moveable jaw **35** further comprises a slot **61** formed between the first **52**, second **54** sides (as shown in **Figures 6** and **14**). The slot **61** formed in the moveable jaw **35** is configured so as to receive or accommodate (the path of such receiving is indicated by reference **T**, shown in **Figure 6**) so as to operably capture the annular flange **64** (when assembled therewith in the manner shown in **Figure 8**) of the operable element **40**, while allowing it to rotate about the axis **M**. Rotation of the operable element **40** about the axis **M** causes translational movement (via the threaded engagement between the operable element **40** and the blind hole **43** of the fixed jaw **30**) of the annular flange **64** along the axis **M** which, with the annular flange **64** being caught within the slot **61**, drives movement of the moveable jaw **35** (away from the landing face **11** in the increasing direction of axis **L**) due to the annular flange **64** pushing against the moveable jaw **35**.

[00150] The annular flange **64** is formed of circular form to allow it to rotate with the slot **61** between leg portions **56**, **58**, and its flange portions are provided with structurally sufficient 'shoulders' so as to bear against the interior walls of the slot **61** with sufficient force for driving the moveable jaw **35**.

[00151] The operable element **40** is arranged so as to operably associate the fixed **30** and moveable **35** jaws so that the attachment assembly **25** is responsive to operation of the operable element **40** in a first mode, in which the moveable jaw **35** is caused to be moved (or separated) away from the fixed jaw **30** subjecting the shroud **17** to a force for retaining the GET **15c** with the edge portion **10**, and, a second mode of operation, in which the moveable jaw **35** is caused to be moved toward the fixed jaw **30** thereby reducing or releasing the shroud **17** from the applied force for facilitating removal of the GET **15c** from the earthmoving equipment/vehicle.

[00152] The operable element **40** further comprises annular seal elements **70**, **72** (such as for example, rod wipers/scrapers, o-rings, and the like) (see **Figures 6** and **7**) provided about the shaft portion **59** between the distal end of the shaft portion and the annular flange **64**. The seal elements **70**, **72** serve to protect (to the extent possible) operable regions of the operable element **40** (eg. the threaded regions which engage) from ingress of 'fines' during operation of the earthmoving machine. The seal elements **70**, **72** are applied to the operable element **40** during manufacturing assembly of the attachment assembly **25**. In an alternate arrangement, each of the seal elements **70**, **72** could be provided with the blind hole of the fixed jaw **30**.

[00153] **Figure 7B** shows an embodiment **40'** of the operable element in which a nylon block **67** is provided in a recess formed in the threaded portion **49'** of the shaft portion **59'**. As shown in **Figure 7B**, the nylon block **67** is of elongate form (oriented axially so as to align with the axis of the shaft portion **59'**) and positioned so as to sit proud of the exterior surface of the shaft. The placement of the nylon block **67** is configured so as to cooperate with the (male) thread of the threaded portion **49'** so as to seek to reduce, to the extent possible, any "play" that might develop between the operable element **40'** when operable in the blind hole **43**. In this regard, the nylon block **67** serves to operate as a means of conferring/facilitating additional friction for keeping the operable element **40'** in its intended position and limit its tendency to work itself free (due to any "backlash" that might be experienced) during on-going loading cycles during ground engaging operations.

[00154] Briefly, and as will be described in further detail below, in operation, and with the landing face **11** of the lip portion **2** received within the opening **78** of the shroud **17** (which snugly receives the edge portion **10**), in the first mode of operation (mode **I**, indicated in **Figure 14**), driving of the moveable jaw **35** in a first direction $\mathbf{T_S}$ (which is substantially aligned with the axis **M**) on rotation of the operable element **40** about the axis of rotation **M** in the direction of rotation $\mathbf{R_S}$ (rotation-securement) operates to subject the GET $\mathbf{15_C}$ to a force for hold/securing the shroud **17** against the landing face **11** and edge portion **10**. Thus, holding of the GET $\mathbf{15_C}$ against the landing face **11**/edge portion **10** in the first mode **I** of operation involves subjecting the shroud **17** to a force, by way of the separation of the fixed **30** and moveable **35** jaws via operation of the operable element **40**, holding the shroud **17** firmly against the landing face **11**/edge portion **10**.

[00155] Furthermore, in the second mode of operation (mode **II**, indicated in **Figure 14**), driving of the shroud **17** by the moveable jaw **35** in a second direction $\mathbf{T_R}$ (which is substantially

aligned with the axis **M**) on rotation of the operable element **40** about the axis of rotation **M** in the direction of rotation $\mathbf{R_R}$ (rotation-release - which is substantially opposite to the direction of rotation $\mathbf{R_S}$) operates to release a force causing the shroud **17** to remain in its 'held' position against the edge portion **10**. The removal of the shroud **17** in the second mode **II** therefore involves reducing a force, by way of reducing the separation of the fixed **30** and moveable **35** jaws via operation of the operable element **40**, to which the shroud **17** is subject to in holding it against the edge portion **10**.

[00156] It will be appreciated that the directions of rotation $\mathbf{R_S}$, $\mathbf{R_R}$ of the operable element **40** that correspond with respective modes of operation **I**, **II** can be changed (for example, reversed) as might be desired for reasons of convenience (eg. for operators in the field) or application. The skilled reader would readily appreciate that such a change can be made by changing the configuration of the engaging (male/female) threads applied to the shaft portion **59** of the operable element **40** and to the blind hole **43**.

[00157] The channel **38** is configured for receiving the boss **32** when the shroud **17** is being positioned relative to the edge portion **10** for securement thereto. In one form of assembly, the fixed jaw **30** is first interconnected with the boss **32**, and the shroud **17** fitted in position relative to the landing face **11** and the edge portion **10** for securement. Thus, in at least one embodiment, the channel **38** is configured so as to be substantially parallel to a longitudinal extent of the shroud **17** and operable for receiving both the boss **32** and the fixed jaw **30** when the shroud **17** is being positioned relative to the edge portion **10**. The channel **38** may be configured so as to be complementary in shape to the effective shaping/profile of the boss **32** and the fixed jaw **30** when in their affirmative/interconnected engagement such that both can be snugly received and retained in the channel **38** when the shroud **17** is in position such that the shroud is restricted to move relative to the boss **32** and the fixed jaw **30** along a length of the channel **38**. As shown, the boss **32** and the fixed jaw **30** are configured having tapering/ dove-tail sidewalls so that as the channel **38** slides over the boss **32** and the fixed jaw **30** the shroud **17** self centres and self-aligns with respect to the boss **32** (and the interconnected fixed jaw **30**). Such interaction, advantageously, enhances the fit of the shroud **17** with respect to the edge portion **10**.

[00158] Of course, embodiments can be realised where the operability described above may only be required in respect of the boss **32** itself, for example, where the fixed jaw **30**, while interconnected with the boss **32**, has a smaller profile not warranting shaping for interacting with the channel **38**.

[00159] When fitting the shroud **17** to the landing face **11** and edge portion **10**, the channel **38** is positioned relative to the boss **32** and the fixed jaw **30** so that the shroud **17** can be slidingly received there over, and the edge portion **10** is received in the first opening **78**. The channel **38** may commence a distance from an end of the shroud **17** distal of the ground engaging region $\mathbf{17_{G\text{-}E}}$ of the shroud, and extend towards the ground engaging region $\mathbf{17_{G\text{-}E}}$ and terminating a distance therefrom.

[00160] One embodiment for installing the GET $\mathbf{15_C}$ using the attachment assembly **25** will now be described.

[00161] Broadly, during instalment of the GET $\mathbf{15_C}$ with the edge portion **10** of the lip portion **2**, the shaft portion **59** of the operable element **40** is inserted into and threadedly engaged with the blind hole **43** of the fixed jaw **30**. Once the fixed jaw **30** and the operable element **40** are engaged with one another, the fixed jaw is placed into its interconnecting relationship with the end **33** of the boss **32**.

[00162] With reference to **Figure 10**, with the fixed jaw **30** interconnected with the boss **32**, the shroud **17** is manoeuvred (for example, in direction **Y** which is generally aligned substantially parallel with the axis **L**) so that its opening **78** (snugly) receives the landing face **11** and the edge portion **10** with the channel **38** passing over the boss **32** and the interconnected fixed jaw **30**, thereby achieving the configuration shown in **Figure 11**. In this manner, the GET $\mathbf{15_C}$ is positioned in respect of the landing face **11**/edge portion **10** and ready to be constrained in position as the fixed **30** and moveable **35** jaws are caused to separate during operation of the attachment assembly **25** in the first mode.

[00163] With reference to now to **Figure 12**, once the shroud **17** is in position relative to the boss **32** and the interconnected fixed jaw **30**, the moveable jaw **35** is then manoeuvred (for example, in direction **S** (which is generally aligned parallel with axis **H**), as indicated in **Figure 12**) so as to be inserted into the channel **38** via the upper opening **37** such that the annular flange **64** of the operable element **40** is received (and captured) within the slot **61** of the moveable jaw **35**, thereby achieving that shown in **Figure 13**.

[00164] Of course, the skilled reader will appreciate other orders of operation that resolve in the assembly of the attachment assembly **25** with the shroud **17** required, depending on the circumstances to hand.

[00165] With reference now to **Figure 14**, operation of the attachment assembly **25** in securing the GET **15c** in position with the bucket **5** will be described.

[00166] Following from that shown in **Figure 13**, an operator then attends to manual operation of the operable element **40** by way of engaging an appropriate drive tool with the drive cavity **62** of the head portion **60**.

[00167] For securing the GET **15c** with the landing face **11**/edge portion **10** (ie. the first mode of operation; denoted as `I` in **Figure 14**), the operator rotates the operable element **40** in the first direction **Rs** of rotation (rotation-securement, eg. clockwise) about the axis **M** thereby causing the annular flange **64** to translate axially along the axis **M** toward the left of page in direction **Ts** (translate-securement). In this manner, axial movement of the annular flange **64** (ie. increasing movement away from the landing face **11** along axis **L**) pushes against the moveable jaw **35** axially causing it to be moved/driven away from the fixed jaw **30** - this is due to the affirmative/positive engagement between the annular flange **64** and the moveable jaw **35** via the slot **61**. In turn, the moveable jaw **35** pushes against portion(s) of the shroud **17** adjacent the upper opening **37**. In effect, the fixed jaw **30** and the moveable jaw **35** are caused to increasingly space apart from one another on rotation of the operable element **40**. With the fixed jaw **30** interconnected with the boss **32**, and bearing/reacting thereagainst during the rotation of the operable element **40** in the first direction, the shroud **17** is caused to increasingly (with each rotational movement about the axis **M**) bear against the edge portion **10**.

[00168] Thus, the cooperability of the threads applied to the interior facing surface of the blind hole **43** and the exterior surface of the shaft portion **59** of the operable element **40** is such that rotation **Rs** of the operable element **40** about the axis **M** results in axial translation **Ts** of the operable element **40** (to left of the page in **Figure 14**) in the securing of the shroud **17** with the edge portion **10** via the first mode of operation. For the present embodiment, the corresponding direction of rotation of the operable element **40** in achieving securement between the shroud **17** and the edge portion **10** is clockwise (or the reverse direction of rotation as would normally be expected when seeking to affect a tightening of two components threadedly engaged with one another).

[00169] During the securement process, the shroud **17** is pulled up so as to bear snugly against the edge portion **10**, during which gaps **G** (see **Figure 14**) are created following tightening, thus expanding the overall length of the attachment assembly **25**. **Figure 14** shows

the (male) threaded portion **49** of the shaft portion **59** following clockwise (R_S) rotation (using a drive tool inserted into the drive cavity **62**) having established increased separation of the moveable jaw **35** from the fixed jaw **30** and pulling the shroud **17** up to/against the edge portion **10**.

[00170] As the securement process progresses, the tapered/dovetail shaped sides/shoulders **29A**, **29B** of the boss **32** interact with corresponding portions of the interior surface(s) of the channel **38** of the shroud **17**. As the shroud **17** is increasingly pulled up toward the edge portion **10**, the interaction of the tapered/dovetail shaped sides/shoulders **29A**, **29B** with the corresponding portions of interior surface of the channel **38** serves to help locate/converge the shroud **17** toward a desired (aligned/centered) position where it is held tightly against the edge portion **10**. As shown in **Figure 4**, the shape of the sides **29A**, **29B** is such that they taper from the base of the boss **32**, where it meets with the surface of the edge portion **10**, outward as the boss extends away from the surface of the edge portion. Interaction between the tapered/dovetail shaped sides/shoulders **29A**, **29B** of the boss **32** and corresponding portions of the interior surface(s) of the channel **38** of the shroud **17** assist in limiting or reducing the stresses that can become induced on the components of the attachment assembly **25**.

[00171] Furthermore, the fixed jaw **30** comprises opposite sides **34A**, **34B** which are shaped or configured so as to substantially continue the tapered/dovetail shaping of the sides **29A**, **29B** of the boss **32**, as shown in **Figure 5**. In this regard, the shape of the sides **34A**, **34B** of the fixed jaw **30** is therefore configured so as to be substantially consistent with respective adjacent sides **29A**, **29B** of the boss **32** such that sides **34A**, **34B** taper from the base of the fixed jaw **30**, where it meets with the surface of the edge portion **10**, outward as the fixed jaw extends away from the surface of the edge portion. In this configuration the sides **34A**, **34B** of the fixed jaw **30** are substantially flush with their respective adjacent side **29A**, **29B** of the boss **32**.

[00172] The continuance of the tapering/dovetail shaping across the sides **29A**, **29B** of the boss **32** and the sides **34A**, **34B** of the fixed jaw **30** assists in the interaction with the channel **78** of the shroud **17** as the shroud **17** is pulled up toward/against the edge portion **10** ensuring that the movement is as fluid as possible with minimal disruption, if any.

[00173] As will be seen from the Figures, both the fixed jaw **30** and the moveable jaw **35** are configured so as to be substantially symmetrical about a vertical plane passing through the axis **M**.

[00174] During operation of the earthmoving equipment/vehicle, it is often the case that the GETs **15** develop a degree of 'play', which can reduce their efficiency during use. The attachment assembly **25** is advantageous in that such 'play', when identified, can be readily reduced by way of an operator simply attending to the operable element **40** and rotating same in the first direction of rotation as would be done during installation. Thus, the configuration of the attachment assembly **25** allows for ready installation of the GET **15C** as well as for subsequent 'retightening' or positive adjustment during use of the GET **15C**. For the present embodiment, around twice the length of the male thread applied to the threaded portion **49** of the shaft portion **59** of the operable element **40** is provided on the interior surface portion of the blind hole **43** to allow for tightening/retightening purposes. The skilled reader will understand that this could be configured as might be required for specific application/use.

[00175] Removal of the GET **15C** from the landing face **11**/edge portion **10** initially requires, if necessary, removal of any fines that have accumulated in any exposed crevices about the shroud **17**. Thus, an initial stage of the removal operation may involve removing fines from back of the shroud **17** and from inside the attachment assembly **25**, especially the drive cavity **62** of the operable element **40**. The objective of this stage is to remove any fines that may impede access to, and operation of, the operable element **40**.

[00176] With respect to **Figure 14**, once any accumulated fines are removed, removal of the GET **15C** using the attachment assembly **25** is achieved by way of the operator rotating (using a drive tool) the operable element **40** in the second direction **R_R** of rotation (rotation-release, eg. counterclockwise) about the axis **M** in a manner causing the operable element **40** to translate axially along the axis **M** toward the right of page in direction **T_R** (translate-release) (ie. the second mode of operation, denoted as `II` in **Figure 14**) thereby causing the annular flange **64** to push against the moveable jaw **35**. In this manner, movement of the moveable jaw **35** pushes against the shroud **17** so as to move the shroud toward the front landing face **11** of the edge portion **10** sufficiently to remove the securing force. This process helps to free the shroud **17** from the edge portion **10** and/or the 'dovetail' shaped sides/shoulders **29_A**, **29_B** of the boss **32**.

[00177] As foreshadowed above, the direction of the second direction of rotation **R_R** about the axis **M** is counterclockwise, or the reverse of that for the securement process (first mode of operation `I`).

[00178] As noted, it is often the case that removal of a GET **15C** is difficult due to fines incurred from ground engagement events accumulating in exposed crevices (which can become significantly compacted) of the shroud **17** and/or the attachment assembly used to fasten/secure the GET **15C** with the edge portion **10**. To assist in the removal of the GET **15C** when used on the connection with the attachment assembly **25** described herein, one or more portions of the shroud **17** that are adjacent to edges of the upper opening **37** of the shroud **17** is/are formed having angled or inclined faces **80A**, **80B**, **80C** that are shaped/configured so as to be of use in the extraction of the moveable jaw **35** from the upper opening **37**. The angled or inclined faces **80A**, **80B**, **80C** are configured so as to slope downward so as to expose side portions of the moveable jaw **35** that are configured so as to provide respective slots (collectively, **85**) formed therein which slots can be used for prising/leveraging of the moveable jaw **35** from the upper opening **37** if needed.

[00179] As shown in **Figure 7A**, **8**, and **14**, angled/inclined face **80A** slopes downward to expose and facilitate access to the opening of slot **85A**, angled/inclined face **80B** slopes downward to expose and facilitate access to the opening of slot **85B**, and angled/inclined face **80C** slopes downward to expose and facilitate access to the opening of slot **85C**. Each of the slots **85**, once exposed (ie. any relevant fines removed so as to enable access thereto) can be used as points of leverage for extracting the moveable jaw **35** from the upper opening **37** (for example, by inserting an end of a crowbar or equivalent into the relevant slot **85** and working the moveable jaw **35** upwards). As seen in **Figures 7** and **8**, the sides **86**, **87** of the moveable jaw **35** comprise respective sets of three slots **85B**, **85A** each of which can be used as required in the prising/leveraging of the moveable jaw **35** from the opening **37**.

[00180] Accordingly, with any accumulated fines removed, once the shroud **17** is pushed forward to the desired position, a crowbar or equivalent can be inserted into any of the slots **85** (ie. upper slot **85C** or side slots **85A**, **85B**) of the moveable jaw **35** to prise/leverage the configuration out through the upper opening **37** in the top of the shroud **17**. The tapered form of the angled/inclined faces **80A**, **80B**, **80C** serves to facilitate this process. In some instances, the operable element **40** may need to be manipulated as appropriate so that the shaft portion **59** is turned slightly back clockwise prior, to remove the portions of the annular flange **64** that make contact with the moveable jaw **35** to allow easier extraction (ie. to reduce or eliminate any relevant bearing forces that may still exist). Movement of the operable element **40** in either directions **TS**, **TR** may be needed as appropriate in order to cause sufficient release of the moveable jaw **35** form the upper opening **37**.

[00181] While the attachment assembly **25** described herein is in the context of a GET **15c** configured for attachment with a respective corner of the edge portion **10** of the bucket **5**, it will be appreciated that embodiments of the attachment assembly **25** could be readily applied for use in securing the alternate version of the GET **15** (ie. those disposed between the corners of the bucket **5**) without departing from the principles described herein. As the skilled reader would appreciate, it can be the case that more adversity is encountered when seeking to remove the corner GETs **15c**, for at least the reason that it is these GETs that are more exposed (ie. being exposed both to the side and front aspects of the bucket) during operation than those GETs residing between the corner regions.

[00182] As the skilled reader would be well aware, the shrouds **17** of the GETs **15** are made from ground engaging grade steel. Other metallic components used on the attachment assembly **25** are formed from other steel compositions (as appropriate for their operation), and some of the componentry, such as for example 'o'-rings and rod wipers/scrapers are formed from rubber, plastic, or steel/rubber/plastic laminates. The skilled reader would be well aware of the materials from which various of the componentry described herein is appropriately formed.

[00183] Additional features may comprise plugs for use in filling/plugging any gaps or cavities which form on the top (upper facing side of the shroud **17**; for example, around the upper opening **37**), and/or the rear side **24** as the attachment assembly **25** is operated in the first mode for fastening the GETs **15c** in position against the edge portion **10**, as such gaps/cavities can readily allow for the build-up of fines during operation of the earthmoving machine. The geometry of appropriate parts may be configured as required so as to facilitate extraction of the moveable jaw **35**. Furthermore, other means may be configured so as to operate to restrict or limit the build-up of fines, such as for example, plugs, sprays, liquids, etc.

[00184] The attachment assembly **25** may further comprise, or be arranged operable with, a retention means, device, or system operable between a portion of the moveable jaw **35** and a portion of the shroud **17** or the operable element **40** for establishing a mutual engagement or interaction (preferably in a substantially quick or snap fit manner) that is operable for retaining or preserving the position of the moveable jaw **35** relative to the shroud **17** following insertion/placement of the moveable jaw **35** through or into the upper opening **37** (ie. the retention means/device operable so as to impede the moveable jaw **35** from lifting upwards through the upper opening **37**).

[00185] For example, in one embodiment shown in **Figures 24** to **26**, the moveable jaw **35** is configured so as to carry a retainer element **100** configured operable for engaging with the shroud **17** for preventing/impeding the moveable jaw **35** from working its way upwards and out of the upper opening **37**; for example, in cases when, if, prior to the need for retightening of the attachment assembly **25** is identified, the attachment assembly develops sufficient play that increases a risk that the moveable jaw **35** could work free (eg. if the operable element **40** is not sufficiently tight up against the moveable jaw **35**). With specific reference to **Figures 24** and **25**, the retainer element **100** is shown bonded with a side of the moveable jaw **35** by way of a vulcanisation process. The bonding region between the retainer element **100** and the moveable jaw **35** is identified by the black solid region marked "Bond line". While a vulcanisation bonding process has been used for the embodiment shown, the skilled reader will appreciate that other bonding/adhesive processes/technologies could be used as appropriate.

[00186] With specific reference to **Figures 24** to **26**, for the most part, the retainer element **100** is of finite thickness and generally of uniform cross section. The general form of the retainer element **100** echoes the general form of the opening **50** of the moveable jaw **35**. In this regard, the retainer element **100** comprises a similar arch like form (similar to the arch like form of the moveable jaw **35** seen clearly in **Figure 6**) dimensioned so as to receive the shaft **59** of the operable element **40** when the slot **61** of the moveable jaw **35** receives the annular flange **64** during assembly/insertion through the upper opening **37** in the shroud **17**. With reference to **Figure 24**, the retainer element **100** comprises spaced apart leg portions **110**, **115** extending respectively from respective base portions **112A**, **112B** (adjacent the open region of the arch like form) upwards to spaced apart shoulder portions **120**, **125**. The distal extents of each of the shoulder portions **120**, **125** function to engage with respective corresponding portions **130**, **135** provided on an interior surface of the channel **38** (see **Figure 14**) of the shroud **17**, as clearly shown in the cut-away cross section drawing shown in **Figure 26** – in which the retainer element **100** is shown in its operable state preventing or preserving the position of the moveable jaw **35** relative to the shroud **17**, ie. impeding the moveable jaw **35** from working its way upwards and out of the upper opening **37**. An end **128** distal of the base portions **112A**, **112B** provides a recessed area **130** which opens to the slot **85a** (seen in **Figure 5**) of the moveable jaw **35**, which slot provides a means for a tool to be insertable therein and used for affirmatively leveraging the moveable jaw **35** out of the upper opening **37** for replacement/maintenance purposes.

[00187] The retainer element **100** shown is formed of an elastomeric material, such as for example a vulcanized rubber material (eg. having a Shore A 60 hardness), so as to comprise a degree of resilience (ie. a resilient characteristic) allowing the retainer element **100** capacity to exhibit a degree of deformation when subject to a handling operation involving a compressive action causing the shoulders **120**, **125** to be brought or squeezed toward each other (by manual manipulation as a quick fit operation or by way of being forced or pushed/hammered through the small size space **37B** of the upper opening **37**) so as to reduce the profile of the retainer element **100** sufficient for insertion into/through the small size space **37B** of the upper opening **37**, and being capable of returning to its normal form on cessation of the handling operation (ie. release of the compressive action once through the small size space **37B**). Accordingly, the term 'resilience' or 'resilient' is used in the context whereby the retainer element **100** is able to return to its normal shape or form (once through or clear of the periphery defining the small size space **37B** of the upper opening **37**) following completion of the insertion of the moveable jaw **35** and the retainer element **100** through the upper opening **37** so that the shoulder portions **120**, **125** (shown in **Figure 26**) are engageable with the respective corresponding portions **130**, **135** provided on the interior surface of the channel **38** (as shown in **Figure 26**) of the shroud **17** in order to provide the retaining/retention functionality to ensure that the position of the moveable jaw **35** relative to the shroud **17** is maintained/preserved (ie. the moveable jaw **35** is sufficiently impeded from lifting upwards out of such position relative to the shroud **17**). The resilient characteristic or property of the material from which the retainer element **100** is formed from is selected so as to ensure that the engagement between the retainer element **100** and the shroud **17** is of sufficient structural integrity or capacity to function accordingly.

[00188] Installation of the moveable jaw **35** when carrying the retainer element **100** involves compressing or forcing, or causing/facilitating same, both its shoulders **120**, **125** toward each other sufficiently (by manual or forced action) so that both components are insertable through respective regions of the upper opening **37** into the desired position. Once in position, the resilience of the retainer element **100** enables the shoulders **120**, **125** to expand or return to their normal shape/form so as to be engageable with respective corresponding portions **130**, **135**. In the removal of the moveable jaw **35** where the retention element **100** is used, an initial step will require the retainer element **100** (or any portion(s)/projection(s) thereof) to be disengaged from the moveable jaw **17** regardless of whether the retainer element **100** is carried by the moveable jaw **35** or the shroud **17**.

[00189] While the retention element **100** is formed from rubber, the skilled reader would be aware of other types of materials and/or constructions that could be used. In this regard, any portion or component of the retention means/device may comprise (i) a metallic material (eg. a suitable spring steel), or (ii) an elastomeric material (eg. vulcanised rubber or otherwise), or (iii) a combination of both a metallic and an elastomeric material (such as retainer elements **102A**, **102B** shown in **Figures 27** and **28**, and described below). The skilled reader will appreciate that any suitable hard wearing metallic (eg. spring steels or similar) or elastomer/elastomeric type material could be used that the skilled person would consider appropriate for the function and intended operating environment.

[00190] Arrangements of the retention means/device may be configured so as to be attached or carried by either the moveable jaw **35** or the shroud **17**. In the embodiment shown in **Figures 24** to **26**), the retainer element **100** is attached (bonded) with the moveable jaw **35** whereby the shoulder portions **120**, **125** are engageable with respective corresponding portions **130**, **135** of the channel **38** of the shroud **17** by way of, at least in part, the resilient characteristic of the retainer element **100** allowing the engagement to occur by virtue of the form of the retainer element **100** returning to its normal shape/form following insertion with the moveable jaw **35** and the retainer element **100** into/through the upper opening **37**.

[00191] Alternatively, a form of a retention means/device can be attached with the shroud **17** whereby, in at least one arrangement, such retention means/device may comprise one or more projections that are bonded to one or more interior surfaces of the shroud 17 and that are configured to be engageable with one or more respective corresponding recesses formed in the moveable jaw **35** by way of, at least in part, a resilient characteristic (retention means/device) enabling the projection(s) to enter the respective recess(es) once the moveable jaw **35** is inserted through/into the upper opening **37** into its desired relative position with the shroud **17**. During installation the relevant projection(s) may need to be manipulated so as to allow the moveable jaw **35** to be inserted through the upper opening **37** and positioned appropriately, following which the projection(s) can be allowed to expand into the respective corresponding recesses. Removal will require the moveable jaw **17** to be disengaged from the retention means/device.

[00192] In another arrangement, a form of a retention means/device may be configured so as to be carried by or attached with the moveable jaw **35** and configured so as to engage or interact with the operable element **40** (for example, via an engagement or interaction with a

portion or section of the shaft **59**) in operating to prevent or impede the moveable jaw **35** from lifting upwards through the upper opening **37**.

[00193] The skilled reader will appreciate that many different configurations are possible in which the retention means/device could be carried by the moveable jaw **35** (and, indeed, by the shroud **17**). For example, **Figures 27** and **28** both show an arrangement of a retention means/device that is different to that shown in **Figures 24** to **26**. **Figure 27** shows a view looking from the rear of the excavator bucket toward the front lip of the bucket (in the direction of **VR** identified in **Figures 28** and **29**) indicating areas **A1** and **A2** where metallic retainer element(s) or clips **102A**, **102B** are operably attached/associated with the moveable jaw **35** for operable engagement with respective corresponding portions **104A**, **104B** (not shown but inferred) of the interior of the channel **38** of the shroud **17**. **Figure 28** shows a cut-away section of the retainer element **102A** (area **A1** identified in **Figure 27**) projecting outward from a side of the moveable jaw **35** so as to engage with portion **104A** of the shroud **17**. Retainer element **102A** is of wedge like form and operably associated (using any suitable form of attachment means) with an elastomeric body **103A** which is positioned within a recess **106A** formed within the shown side of the moveable jaw **35**. A portion of the retainer element **102A** is shown to also sit partially within the recess **105A** so as to, in effect, key the moveable jaw **35** with the shroud **17** for impeding upward movement of the moveable jaw **35** back through the upper opening **37**. Consistent with the description above, as the moveable jaw **35** is inserted through the upper opening **37**, the resilient nature of the elastomeric body **103A** allows the retainer element **102A** to move inwards of the recess **106A** (in a different direction of motion as was seen with the shoulder portions **120**, **125** of the retainer element **100**) due to pressure applied by the sliding engagement between a ramped face **107A** of the retainer element **102A** and the periphery of the upper opening **37**. Once the insertion is completed, and the retainer element **102A** clear of the shroud **17**, the resilient nature of the elastomeric body **103A** pushes the retainer element **102A** outward of the moveable jaw **35** so that a portion of a face **108A** of the retainer element **102A** engages, or is engageable with, its corresponding portion **104A**.

[00194] **Figure 29** shows other areas marked **A3**, **A4**, **A5**, and **A6** adjacent the periphery of the upper opening **37** which could also be used for retention purposes using similar configurations, either attached/carried by the moveable jaw **35** or by regions/portions of the shroud **17**.

[00195] As discussed above, for the case where one or more portions or components of the retention means/device comprises (either individually or in combination) an elastomeric component (for example, a rubber material), the elastomeric portion or component may be configured, whether attached with the moveable jaw **35** or the shroud **17**, so as to be sufficiently compressible or elastically deformable so as to allow for insertion of the moveable jaw **35** through the upper opening **37** into a position relative to the shroud **17** for driving or moving of same, and transitionable to a condition that operates directly or indirectly with the shroud **17**, moveable jaw **35**, or the operable element **40** (as the case/configuration may require) to impede the moveable jaw **35** from lifting upwards out of its position relative to the shroud **17** thereby preserving said relative position.

[00196] For the case where one or more portions or components of the retention means/device comprises (either individually or in combination) a metallic component (eg. spring steel), the metallic portion or component may be formed or configured (for example, in a spring-like manner akin to that shown in **Figure 24**), whether attached with the moveable jaw **35** or the shroud **17**, so as to be sufficiently compressible or elastically deformable so as to allow for insertion of the moveable jaw **35** through the upper opening **37** into position relative to the shroud **17** for driving or moving of same, and transitionable to a condition that operates directly or indirectly with the shroud **17**, moveable jaw **35**, or the operable element **40** (as the case/configuration may require) to impede the moveable jaw **35** from lifting upwards out of its position relative to the shroud **17** thereby preserving said relative position.

[00197] The skilled reader will appreciate that many configurations could be developed that achieve the desired aim of the retention means/device in impeding the moveable jaw **35** from lifting upwards through the upper opening **37** once inserted therethrough/therein. Other hybrid arrangements (like that described above) could also be possible in which a metallic spring configuration is over-moulded with a suitable elastomeric material.

[00198] The shaping of the sides of the shroud **17** and/or various of the sides/faces of any of the components of the attachment assembly **25** (eg. the moveable jaw **35**, any sides/faces of the operable element **40** that might be or become exposed via the rear side **24** of the shroud **17**) could be configured with tapered and/curved faces to help in the expelling of accumulated fines, especially when the attachment assembly **25** is in a condition holding the GET **15c** in position against the edge portion **10**.

[00199] Of course, variations to various of the components described above are possible:

- the design (eg. shape and/or configuration) of the front portion of the shroud **17** can take various/multiple forms. Of course, other types of GETs **15**, other than corner GETs **15c** as described herein, can also be configured so as to operate with embodiments of the attachment assembly **25**.
- the design (eg. shape and/or configuration) of the boss **32** and/or the fixed jaw **30** can differ. For example, the shaping of the interconnecting portions of both components can differ. While a 'dove-tail' "shoulder" profile of the boss **32** is used and described herein, this profile/configuration can differ. Any complementary shaping/configuration can be used. For example, an arrangement relaying on complementary shaped/configured interconnecting portions based around a "T" shape/configuration can be readily employed to achieve the required interconnection between the boss **32** and fixed jaw **30** (while operating to restrain both relative to each other in the appropriate axes).
- While welding of the boss **32** to the edge portion **10** of the bucket **5** is common, they can also be bolted in position.
- Use of the attachment assembly **25** with 'cast-in' bosses are also possible, for example where the boss **32** is cast with the lip portion **2**. In such, instance, the fixed jaw **30** is configured so as to be interconnectable with the form of a boss that is cast with the lip portion **2**. Or, for example, the form of an appropriate boss that is configured interconnectable with an existing (or otherwise) form of a fixed jaw **30**, is provided to a third party for use in casting the boss with a lip portion **2**;
- The form of the shroud **17** of the cast corner **15c** and lip/blade could, of course, vary/differ.

[00200] **Figures 16** to **20** show another embodiment of an attachment assembly **25'** arranged in accordance with the principles described herein. Corresponding and analogous reference nomenclature used for describing the attachment assembly **25** is retained for ease of explanation, and differentiated in the form ***n***'.

[00201] As can be seen from **Figures 16** to **20**, equivalent components are provided for the attachment assembly **25'**, resulting in functionality falling within the principles described herein. As seen in **Figure 19** and the attachment assembly **25'** features a fixed jaw **30'** that is placed in an interconnecting relationship with the boss **32**, a moveable jaw **35'** that is place in an affirmative engagement with the shroud **17'** of the GET **15'c** (via the upper opening **37'**), and an operable element **40'** that operably associates the fixed **30'** and moveable **35'** jaws so that moving or driving of the moveable jaw **35'** operates to hold the shroud **17'** against the

edge portion **10**. For removal of the GET **15'c**, the operable element **40'** is operated so as to move or drive the moveable jaw **35'** toward the fixed jaw **30'** for reducing or removing the 'holding' force.

[00202] **Figure 20** shows a cross-section view of the attachment assembly **25'** used to secure the shroud **17'** in position against the edge portion **10**. As will be clearly seen, the substance of the operable relationship between the functional components is substantially the same as that for the attachment assembly **25**. Thus, it follows that the substance of the method of operation is also consistent as that for the attachment assembly **25** in both the first **I'** and second modes **II'**.

[00203] Of course, the method of separating the fixed **30/30'** and moveable **35/35'** jaws of the attachment assembly **25'** can differ in that the operable element **40/40'** can be arranged so as to not threadedly engaged with the blind hole **43/43'** of the fixed jaw **30/30'**. Instead, the shaft portion **59'**, once inserted, could be arranged so as to be rotatably supported in the blind hole so as to be rotatable about the axis **M'** and fixed so as to not translate axially along the axis **M/M'**. In such a configuration, the moving jaw **30/35'** can be configured so as to be move/driven along the shaft by way of a threaded engagement with the shaft – such that, rotating of the head portion **60'** moves/drives the moveable jaw **35/35'** away from or toward the fixed jaw **30/30'** as required.

[00204] The skilled reader will appreciate other ways that such moving driving of the moveable jaw **35/35'** could be achieved without departing from the principles described herein. For example, and with reference to **Figures 21** to **23**, arrangements can be realised in which the shaft portion of the operable element **40''** is rotatably supported in the blind hole **43''** so that the operable element **40''** itself is unable to move or translate axially along the axis **M** (ie. away from the landing face **11** in increasing direction of axis **L**). In such an arrangement the moveable jaw **35''** is configured so as to be arranged in threaded engagement with a threaded portion **49''** of the operable element **40''** so that the moveable jaw **35''** moves axially there along on rotation of the operable element about the axis **M**. **Figure 21** shows the attachment assembly **25''** (which represents a variation to the attachment assembly **25'**) in exploded form prior to assembly with the shroud **17''** of a GET **15''c**. Once the shroud **17''** is in position, the attachment assembly **25''**, when in assembled form, is inserted through the upper opening **37''** so that the fixed jaw **30''** interconnects with the boss **32''**, which is generally shown in **Figure 22** (where the GET itself is omitted for clarity) whereby the attachment assembly **25''** is ready for operation. The upper opening **37''** and the fixed jaw **30** are of different form to the

embodiments described above, but sufficiently complementary so that the attachment assembly **25''** can be slotted through the upper opening **37''** in an assembled form for interconnection with the boss **32''**. **Figure 23** (again, with the GET **15''c** omitted for clarity) shows the operability of the attachment assembly **25''** on rotation of the operable element **40''** about the axis **M** causing the moveable jaw **35''** to translate axially (along axis M) by moving along the threaded portion **49''** away from the landing face **11** in increasing direction of axis **L**, thereby spacing the fixed **30** and moveable **35** jaws from one another for causing driving of the shroud **17''** against the edge portion **10** (and landing face **11**). As noted above, removal of the holding force is achieved by the reverse operation of the operable element **40''**. Accordingly, while that shown in **Figures 21** to **23** represents a different arrangement to that described above, the same relative movements are achieved, ie. for securement of the GET **15''c** with the landing face **11**/edge portion **10** of the lip portion **2**, the fixed **30** and moveable jaws **35** are caused to be moved away from each other so as to subject the GET to a force holding the GET in position, and, for release, causing the fixed **30** and moveable jaw **35** to be moved toward each other so as to release or disrupt the holding force.

[00205] As will be seen from **Figure 17**, the form/profile (and external shaping) of the fixed jaw **30'** is substantially similar to that of the fixed jaw **30** of the attachment assembly **25**. However, the form/profile of the moveable jaw **35'** is different to its counterpart (moveable jaw **35**) of the attachment assembly **25**. As seen in **Figures 16**, **10** and **19**, the upper opening **37'** of the shroud **17'** is larger than the upper opening **37** of the attachment assembly **25**, but is still formed having a portion of its profile that corresponds with the profile of the moveable jaw **35'** so that both can be placed in affirmative engagement with each other so that holding force/pressure can be applied for securement purposes, and affirmatively removed for removal purposes. As expected (and shown), the moveable jaw **35'** is larger than the moveable jaw **35** of the attachment assembly **25**.

[00206] Accordingly, in substance, the differences between the attachment assembly **25** and the attachment assembly **25'** are as follows.

[00207] In the attachment assembly **25'**, all three components (ie. the fixed jaw **30'**, the moveable jaw **35'**, and the operable element **40'**) are assembled before engagement with the shroud **17'**, and then installed with the shroud through a larger configured opening **37'** (as shown in **Figures 16** and **20**) in the top of the shroud **17'** in one step. An advantage of this arrangement can be seen in that installation of the attachment assembly **25'** can be conducted in a single step. An advantage of the larger profile opening of the upper opening **37'** is that a

failsafe release point is provided which can be used should the thread of the operable element **40'**, for example, seize up making extraction of the attachment assembly **25'** difficult/stubborn. In this manner, access is provided at about the region where the moveable jaw **35'** inserts via the upper opening **37'** so that, in the event that, for example, the thread of the operable element **40'** seizes up making a removal operation more challenging/difficult, access is provided/enabled for allowing a cutting means (such as for example, a grinding blade or oxy gas torch flame) to be used to severe the shaft **59'** of the operable element **40'** for facilitating easier removal of the operable element and the moveable jaw **35'** from within the shroud **17'** of the GET; for example, the cutting/severing process resulting in a portion of the length (eg. about 3-5mm) of the operable element **40'** (eg. its shaft portion **59'**) being eliminated so as to generate enough clearance or play so that both the operable element **40'** and the moveable jaw **35'** can be freed up and manipulated from within the confines of the shroud **17'** of the GET. Indeed, the same space (slightly smaller in size) is shown in **Figure 12** adjacent the lower terminal edge of the angled/inclined face **80c** where a small gap (generally provided by way of the smaller size space **37B** of the upper opening **37**) is provided between said lower terminal edge and the larger space **37A** of the upper opening **37** which will soon be occupied by the moveable jaw **35** (once inserted through the upper opening **37**).

[00208] With reference to **Figure 20**, it will be appreciated that the larger profile of the upper opening **37'** allows access to the portion of the operable element **40'** between the fixed **30'** jaw and the moveable jaw **35'**, which portion is indicated generally by reference "**G**" in **Figure 20**. As the skilled reader will appreciate, seizing of the attachment assembly **25'** when securing the shroud **17'** against the landing face **11**/edge portion **10** of the lip portion **2** involves significant force residing in the relevant components in maintaining the required securing/holding force (ie. the force holding the GET with the landing face **11**/edge portion **10**). Seizing of the attachment assembly **25'** can prevent the attachment assembly from being operated to release such force. Thus, cutting or severing of the portion of the operable element **40'** between the fixed **30'** and the moveable **35'** jaws enables the (holding) force to be released or sufficiently disrupted/reduced by providing clearance for any of the operable components of the attachment assembly **25'** to be manipulated for removal purposes.

[00209] However, a disadvantage of this arrangement is that, for the shroud **17'** to be removed, the complete assembly of the fixed jaw **30'**, operable element **40'** and moveable jaw **35'** needs to be removed also in a single step which requires aligning the assembled components appropriately with the generally complex profile of the upper opening **37'** in view

of the shroud **17'** moving over the fixed jaw **30'** when the attachment assembly **25'** is tightened – making such (re)alignment for removal purposes difficult (and/or time consuming) after use.

[00210] In the attachment assembly **25**, two of the components are first assembled as an initial assembly in that the threaded shaft portion **49** of the operable element **40** is first threadedly engaged with the blind hole **43** of the fixed jaw **30** – in one commercial form, the operable element **40** is provided pre-installed or pre-fitted in the fixed jaw **30**. Once this initial assembly is complete, the fixed jaw **30** (with the operable element **40** threadedly engaged therewith) is interconnected with the boss **32**, following which the shroud **17** is then positioned in place over the boss **32** and the interconnected fixed jaw **30** (and operable element **40**). The next step is the insertion of the moveable jaw **35** into the opening **37** so as to engage the annular flange **64** with the slot **61** for interconnecting both components (the profile of the upper opening **37** being comparatively smaller and less complex than that of the upper opening **37'**, as shown in **Figure 16**). Advantageously, while the moveable jaw **35** is inserted after the shroud **17** is positioned in placed as a separate step, the moveable jaw **35** is positioned through a smaller opening (upper opening **37**) in the top of the shroud **17** which offers a less complex profile and does not require any substantive realignment for removal purposes. In at least one aspect, the reduced complexity of the profile of the upper opening **37** provides less opportunity for fines to accumulate. While the installation of the GET **15c** using the attachment assembly **25** requires more steps than that required for the attachment assembly **25'**, removal of the GET **15c** can be easier and safer than removal of the GET **15'c** using the attachment assembly **25'**.

[00211] Thus, in at least one practical instalment process, the fixed jaw **30** and the operable element **40** are installed, or interconnected with, the boss **32** as an initial process. Once complete, the shroud **17** is then introduced over the boss **32**. Once the shroud **17** is fitted over the boss **32**, the moveable jaw **35** is dropped in through the upper opening **37** (from above). The latter process, which benefits from the operability between the moveable jaw **35** and the operable element **40** via the positive engagement between the slot **61** and the annular flange **64**, enables the moveable jaw **35** to be easily inserted (and removed when needed) for connection with the annular flange **64** through the upper opening **37** – which results in a much simpler arrangement than some existing solutions, especially for the removal process.

[00212] For example, having regard to one such existing solution (described in US 9,540,796 – US'796), the installation process described involves, firstly, the relevantly described GET (20) being placed onto the relevantly described boss (24). Then, insertion of the main

componentry of the relevantly described connection means (30) into a recess into the GET mounted over the boss on the bucket lip. US'796 describes two situations:

1. Where the connection means is protected but requires an additional spacer block (58) to fill the gap that permits the insertion.
2. Where the additional spacer block is not required – in this case the main componentry of the connection means is inserted into an elongate upper opening in the GET, but results in components of the connection means being more exposed to wear during ground engaging activity than the use of the additional spacer.

[00213] For the most part, installation of such assemblies is straight forward, as all relevant componentry is new and clean. A significant issue, however, is in the removal process following the hostility of ground engaging activity causing to ingress fines (and any other related debris) into any exposed gap, recess, or cavity of the equipment resulting in damage or seizing of functional componentry.

[00214] With the presently described principles, all that is needed is to operate the operable element **40** enough so as to release the force being applied to the moveable jaw **35**. This is the same regardless of how far out (or spaced) from the fixed jaw **30** the annular flange **64** has been driven during the installation process (typically, in the order of between from about 2mm to about 3mm is sufficient for applying the necessary retaining or holding force for securement of the shroud **17**. At this point the moveable jaw **35** can be prised out (for example, using any of the apertures **85**) so as to free the shroud **17**. Additional rotation of the operable element **40** would serve to drive or push the shroud **17** forward (in the direction $\mathbf{T_R}$ - translate release - as shown in **Figure 14**), as outlined above.

[00215] By comparison, the solution described in US'796 is disadvantageous for at least the following:

1. The bolt (36) of the connection means described in US'796 needs to be retracted the total distance (up to about 15mm, or potentially more). As noted above, physical retraction is often not easy with the presence of fines and, in some cases, impossible if seized. Only when the bolt is fully retracted can the spacer be prised out and the main componentry removed. Removing the main componentry comes with complications with the GET still being in place.
2. Using the 'no spacer' option attracts substantially the same practical disadvantage as above.

[00216] In the attachment assembly **25'**, the opening **50'** of the moveable jaw **35'** that captures the annular flange **64'** of the operable element **40'** opens to the upper side of the moveable jaw **35'** (relative to its assembled condition, as shown in **Figures 17** and **18**). In the attachment assembly **25**, the opening **50** opens to the lower side of the moveable jaw **35** (relative to its assembled condition, as shown in **Figure 6**).

[00217] In the attachment assembly **25'**, to remove the shroud **17'** the full locking assembly needs to be removed (unless the threaded shaft portion **59'** is cut). This generally requires alignment with shroud opening **37'** which is very difficult after use. In the attachment assembly **25**, only the moveable jaw **35** needs to be removed (through the upper opening **37**). Thus, no alignment is required.

[00218] In the attachment assembly **25'**, due to the head portion **60'** of the operable element **40'** being smaller, the recess or drive cavity **62'** provided in the face **63'** is smaller, and generally less convenient for engagement by a drive or rotation tool, as compared the attachment assembly **25** where the head portion **60** is larger and the recess or drive cavity **62** correspondingly larger.

[00219] Modifications and variations may be made to the present invention within the context of that described herein and shown in the drawings. Such modifications are intended to form part of the inventive concept described in this specification.

Claims

1. An attachment assembly for releasably securing a ground engaging tool (GET) with earthmoving equipment, the attachment assembly comprising:

a first body configured for placement in affirmative engagement with a portion of or in fixed relation with respect to an edge of or associated with the earthmoving equipment;

a second body configured for placement in affirmative engagement with a portion of the GET;

an operable element operably associating the first and second bodies so as to be responsive to operation of the operable element in:

a first mode in which the second body is moved or driven away from the first body with the GET received with respect to said edge, the separation of the bodies operating to apply a force to said portion of the GET for holding the GET with respect to said edge, and

a second mode in which the second body is moved or driven toward the first body thereby releasing said force for removal of the GET,

wherein the second body comprises a slotted region and an opening by way of which a portion of or carried by the operable element is receiveable in the slotted region via one side of the second body for forming an engagement or interconnection between the second body and the operable element for enabling driving movement of the second body via operation of the operable element in the first and second modes.

2. An attachment assembly according to claim 1, wherein said portion of or in fixed relation with the edge is provided in the form of a boss welded or cast at or near a wear edge of or associated with an excavator bucket of the earthmoving equipment.

3. An attachment assembly according to claim 2, wherein the GET comprises a body having a ground engaging region at a first end of said body, the body of the GET comprising a leg portion which extends away from the first end of the body and which is spaced from said body so as to define a first opening configured for snugly receiving a portion of the wear edge during fitment of the GET.

4. An attachment assembly according to claim 2 or claim 3, wherein the first body is configured at or near a first end thereof so as to interconnect with the boss, the interconnection between the first body and the boss serving to place both in fixed

relation with each other in a direction substantially orthogonal to the wear edge or its distal extent.

5. An attachment assembly according to any one of claims 1 to 4, wherein the operable element is of cylindrical form having an axis about which the operable element is movable or rotatable, whereby rotation of the operable element in one direction of rotation serves to enable operation of the first mode, and rotation in the alternate direction of rotation serves to enable operation of the second mode.

6. An attachment assembly according to claim 5, wherein the operable element comprises or is provided in the form of a piston having a head portion and a shaft portion extending from the head portion, the head portion configured so as to be engageable with or by a driving tool, which engagement is operable for moving or rotating the operable element about its axis of rotation.

7. An attachment assembly according to claim 6, wherein the first body comprises a hole having a thread configured for threaded engagement with a threaded portion provided with said shaft portion.

8. An attachment assembly according to claim 7, wherein the operable element comprises or carries an annular flange spaced along the shaft portion from the head portion, the engagement or interconnection between the operable element and the second body for enabling driving movement thereof being established by way of a portion of the annular flange being receivable in the slotted region of the second body.

9. An attachment assembly according to claim 8, wherein operable association of the first and second bodies via the operable element is by way of the threaded engagement of the hole with the operable element and the engagement or interconnection established by way of the receiving of the portion of the annular flange in the slotted region of the second body.

10. An attachment assembly according to claim 8 or claim 9, wherein the second body is configured so as to increase or maximise the portion of the annular flange received or accommodated within the slotted region.

11. An attachment assembly according to any one of claims 7 to 10, wherein the operable element carries or is operable with one or more annular seal elements arranged concentric with or carried by the shaft portion, the or each seal element positionable relative the shaft portion so as to protect one or more regions of thread or of threaded engagement from ingress of debris during ground engaging operations.

12. An attachment assembly according to any one of claims 1 to 11, wherein the second body is configured having one or more portions thereof that interact with or bear against respective corresponding portions of the GET so that the GET follows or is driven by movement of the second body in either of the first, second modes of operation in response to operation of the operable element.

13. An attachment assembly according to claim 12, wherein the GET comprises a second opening in a side thereof and through or into which the second body is insertable/placeable for engaging or interconnecting the slotted region with the operable element and positioning the second body relative to the GET so as to enable said portion(s) of the second body to interact with or bear against said respective corresponding portion(s) of the GET for driving or moving of same in the first, second modes of operation via operation of the operable element.

14. An attachment assembly according to claim 13, wherein the assembly further comprises, or is arranged operable with, a retention means or device operable between a portion of the second body and a portion of the GET or the operable element for establishing mutual engagement or interaction that is operable for retaining or preserving the position of the second body relative to the GET following insertion/placement of the second body through or into the second opening, and wherein the retention means or device comprises:

    (i) a metallic material, or

    (ii) an elastomeric material, or

    (iii) a combination of both a metallic material and an elastomeric material.

15. An attachment assembly according to claim 14, wherein a profile or shape of the second opening of the GET is substantially complementary with a profile or shape of at least one side or aspect of the second body so as to enable the second body to be insertable through the second opening for said relative positioning of the second body with the GET for establishing affirmative engagement therebetween.

16. An attachment assembly according to any one of the preceding claims when dependent on claim 6, wherein the GET comprises a further opening formed in a side thereof configured so as to allow access to the head portion of the operable element for operation thereof via the driving tool.

17. An attachment assembly according to any one of the preceding claims, wherein space is provided between the GET and the second body, said space configured appropriate for enabling access to a portion of the operable element for use in removal of the GET in the event the attachment assembly becomes resistant to operation in the second mode of operation.

18. A method of attaching a ground engaging tool (GET) with a leading or wear edge of or associated with earthmoving equipment, the method comprising:

forming, providing or configuring an attachment assembly according to any one of the preceding claims for releasably securing the GET with said edge,

arranging the first body in operable association with the operable element, and in affirmative engagement with said portion of or in fixed relation with respect to said edge,

positioning the GET in respect of said edge such that a portion thereof receives said portion of or in fixed relation to said edge,

arranging the second body in operable association with the operable element and in affirmative engagement with said portion of the GET,

operating the operable element so as to separate the bodies for applying a force to the GET for holding same with respect to said edge.

19. A method of releasing a ground engaging tool (GET) secured with a leading or wear edge by way of the attachment assembly of any one of claims 1 to 17 or the method of claim 18, the method of releasing the GET comprising: operating the operable element so as to reduce said spaced or separated relation of the first, second bodies for reducing the force applied to the GET for securement purposes.

20. An excavator bucket or wear like component of an earthmoving equipment/vehicle having an embodiment of an attachment assembly according to any one of claims 1 to 17 for releasable securement of a ground engaging tool (GET) therewith.

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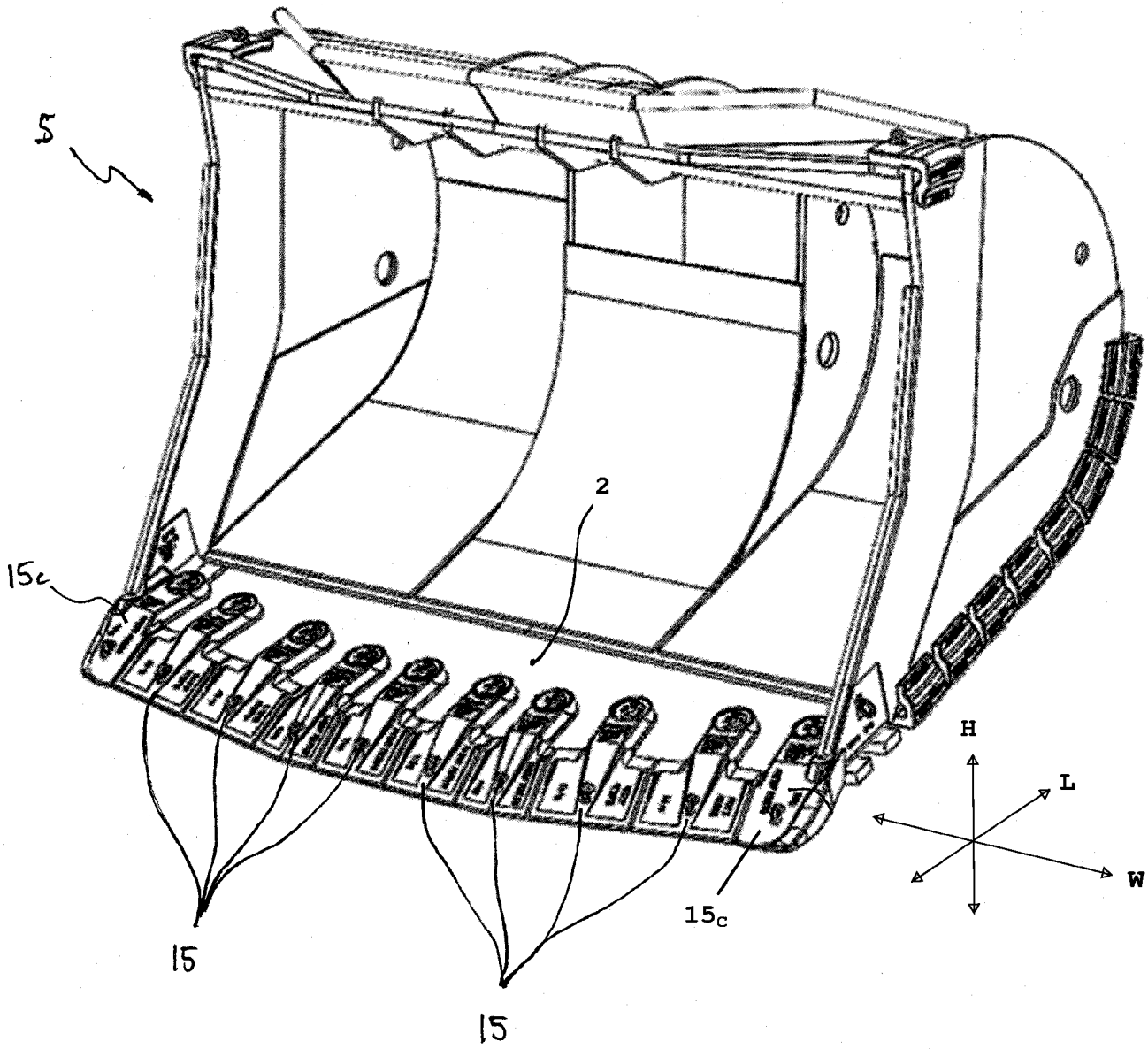

FIGURE 1

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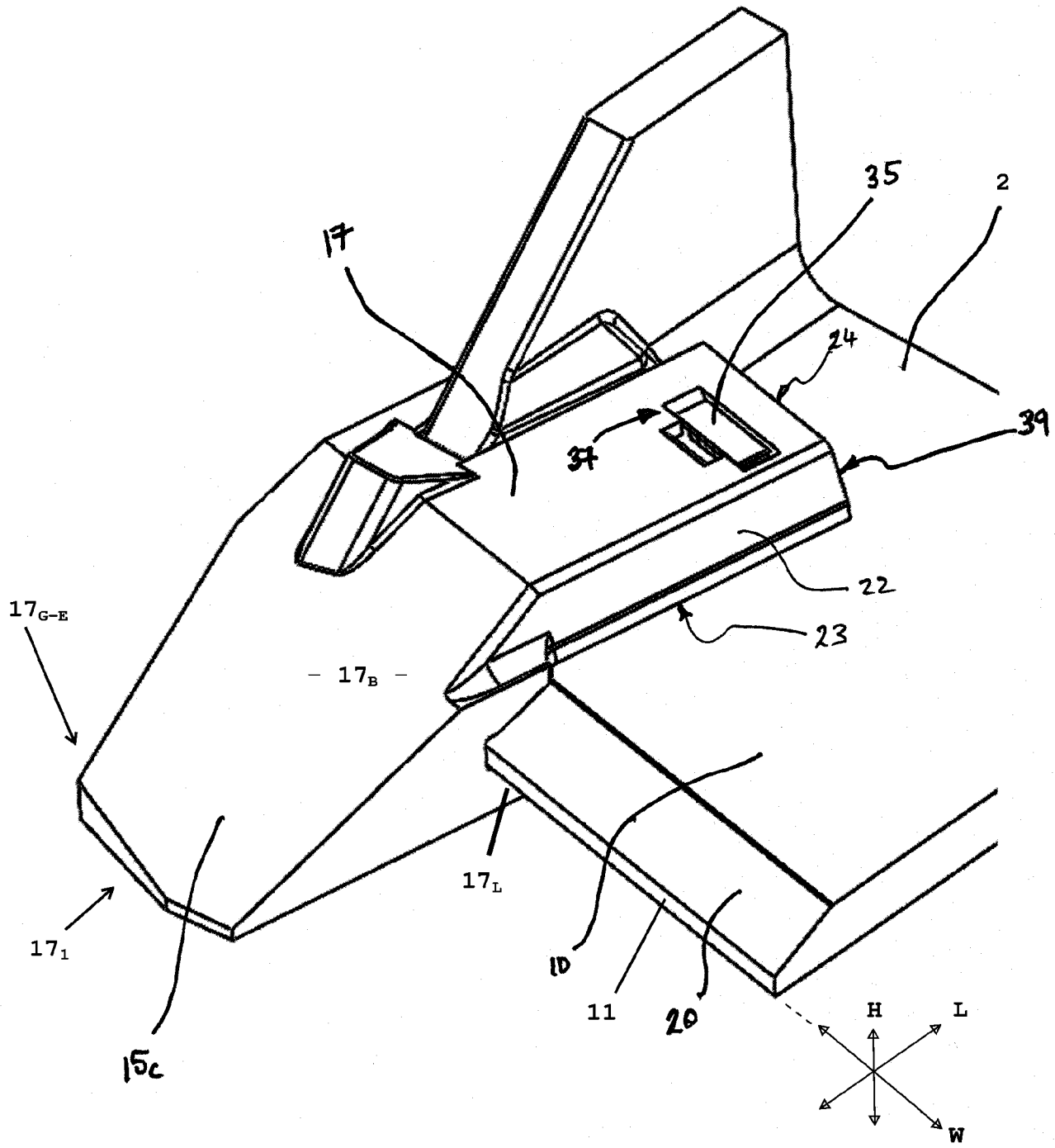

FIGURE 2

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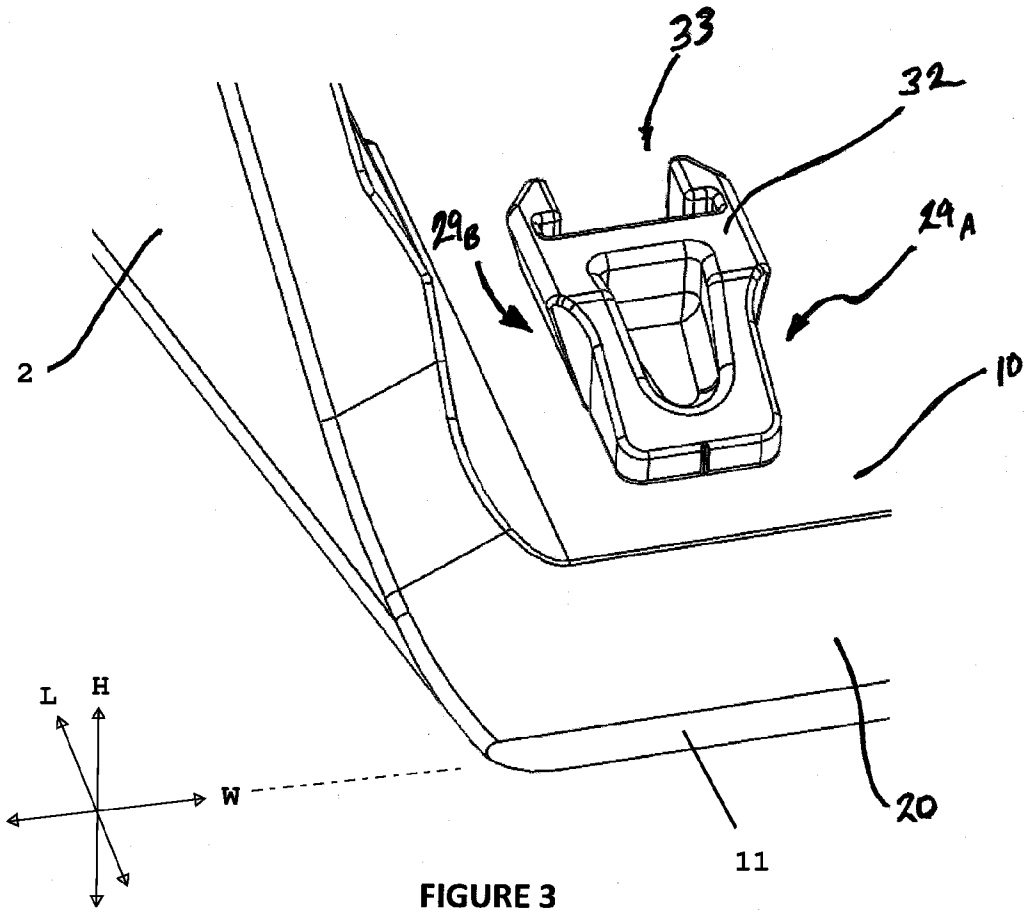

FIGURE 3

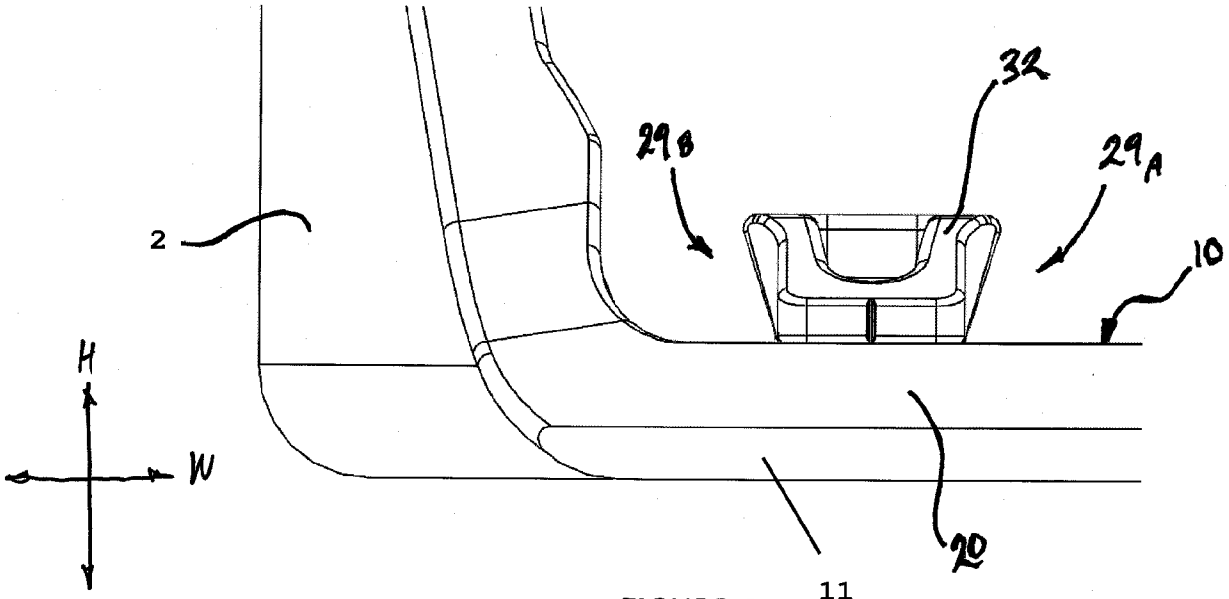

FIGURE 4

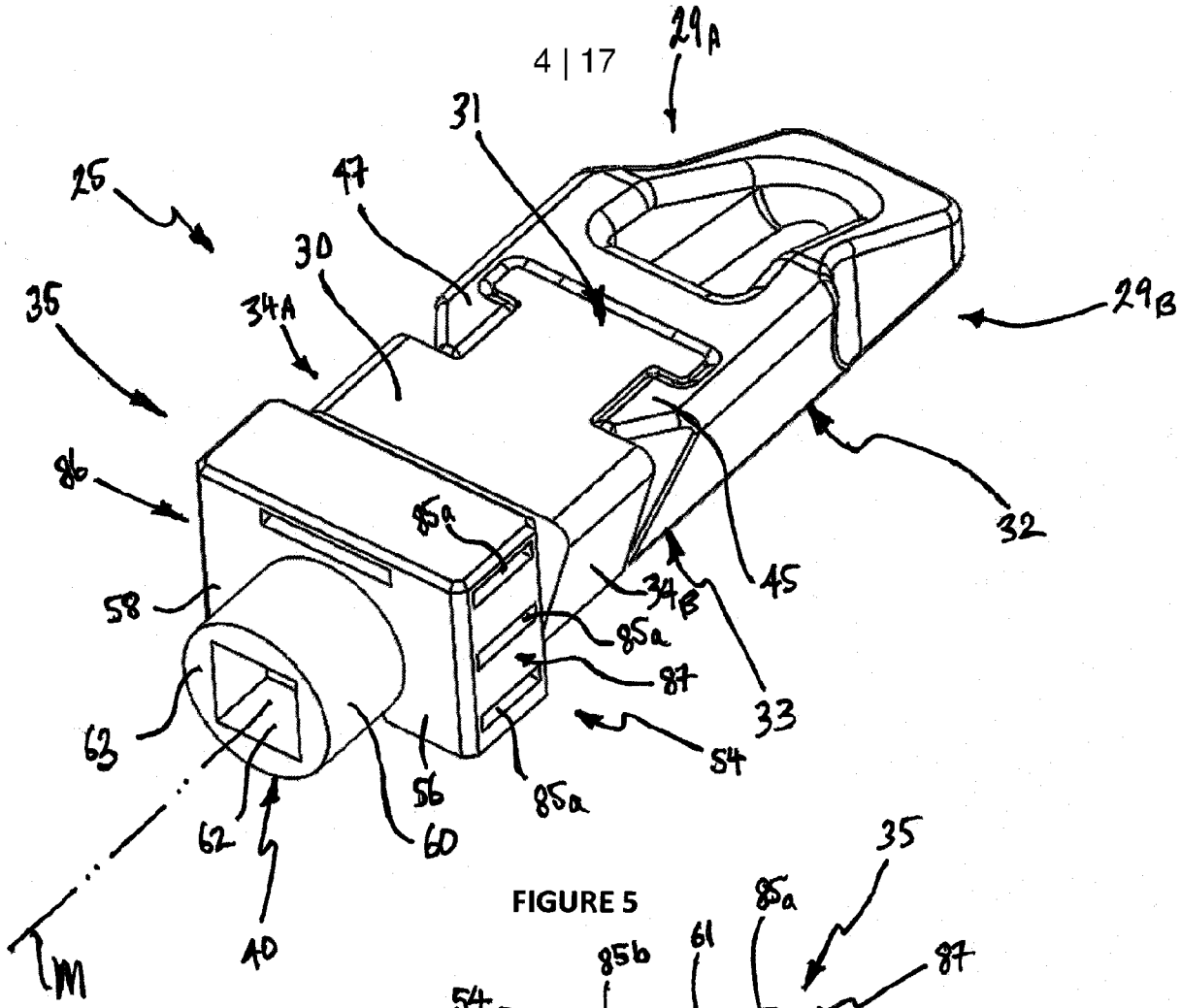

FIGURE 5

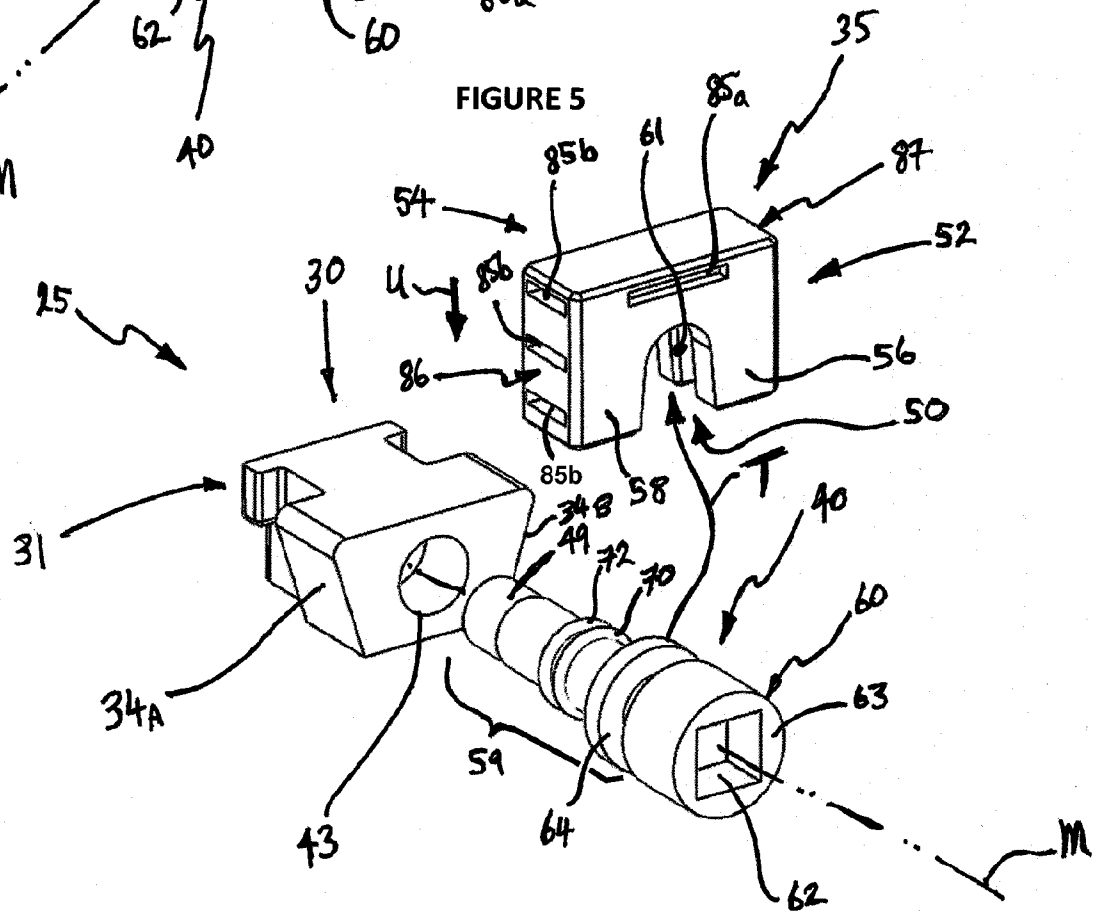

FIGURE 6

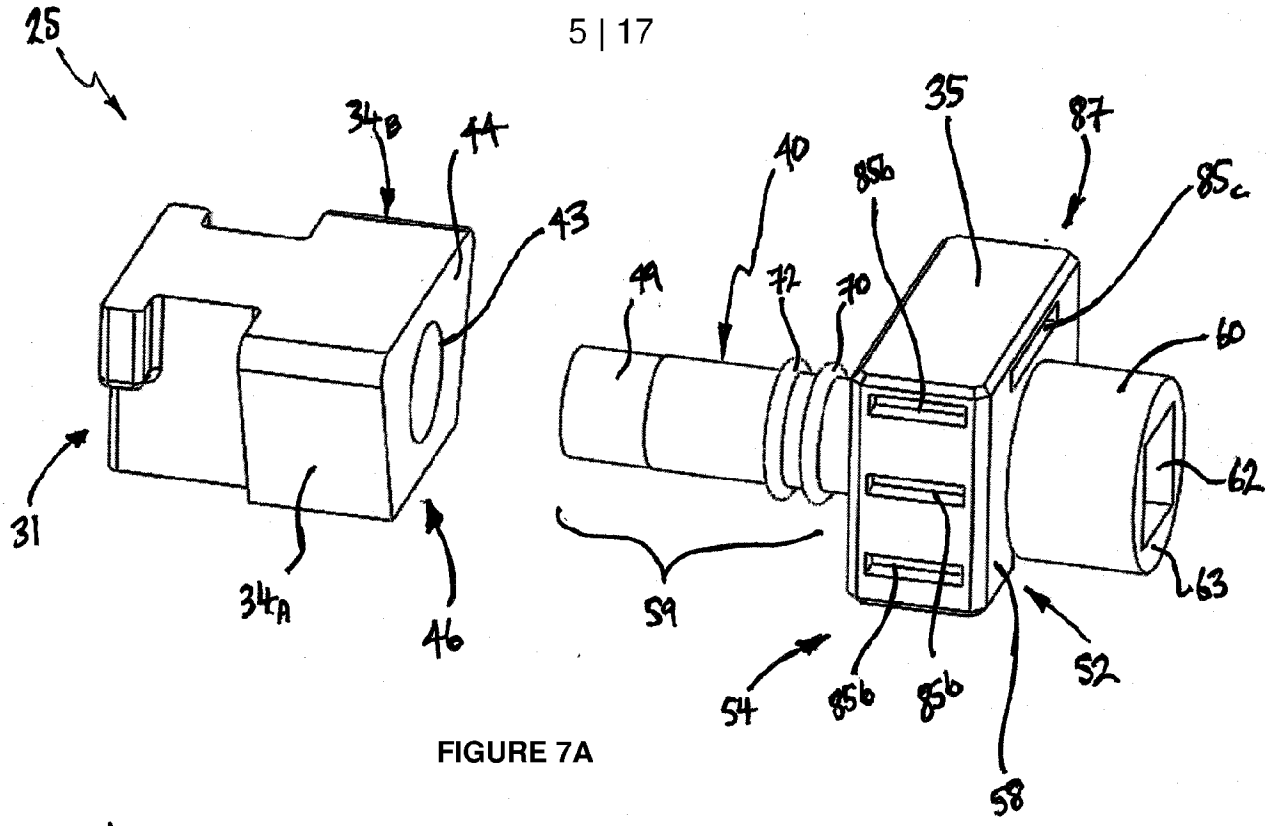

FIGURE 7A

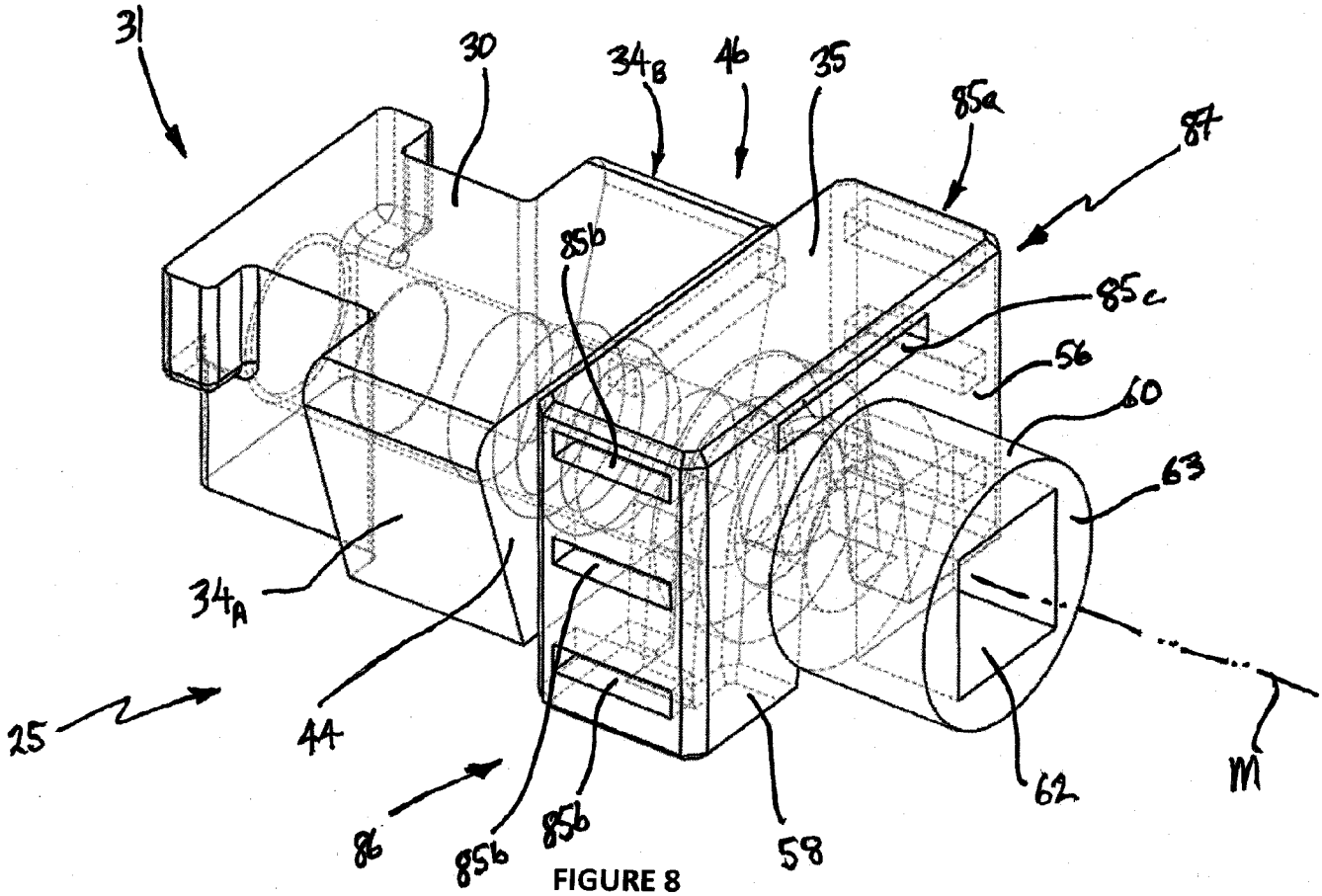

FIGURE 8

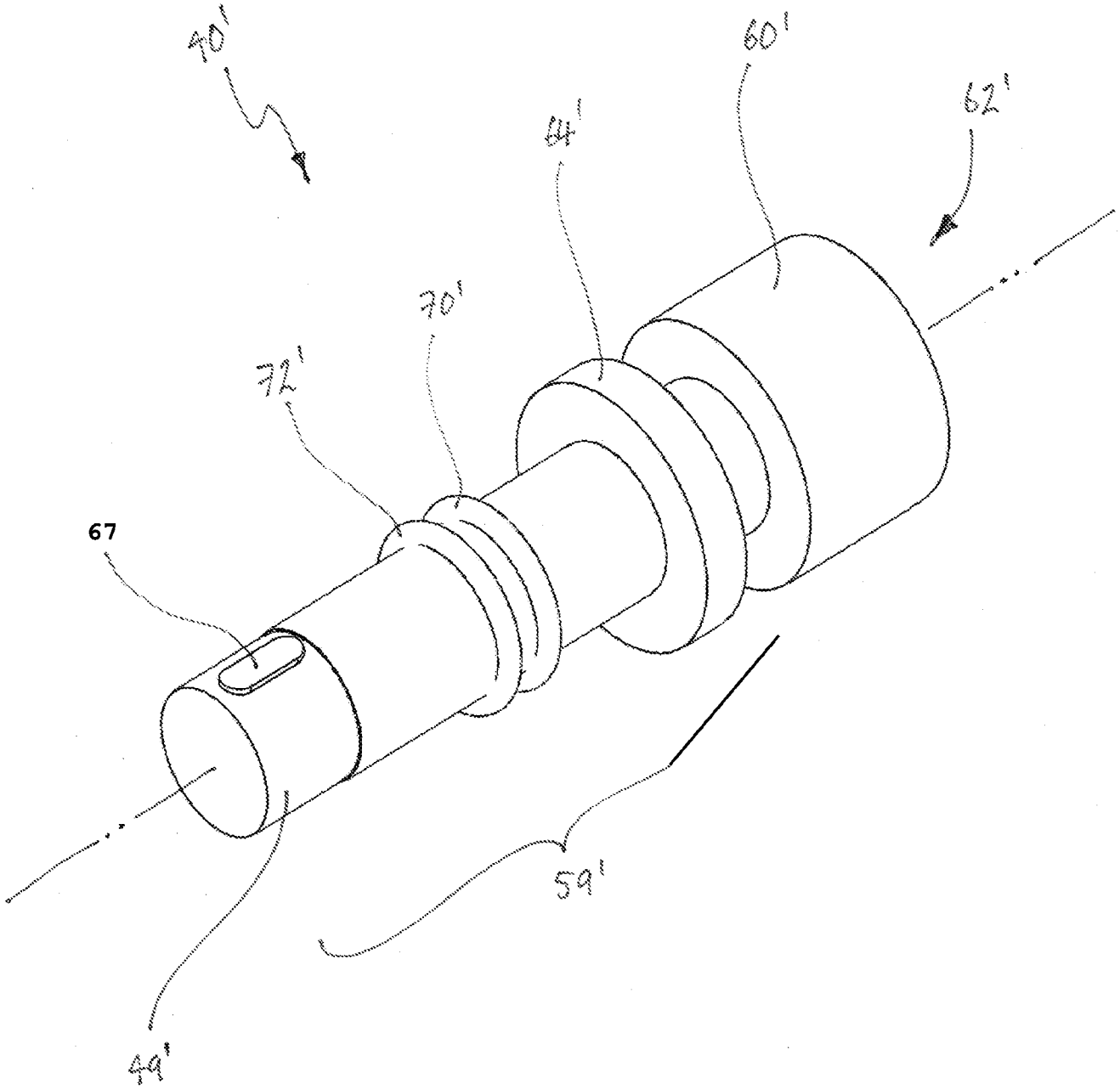

FIGURE 7B

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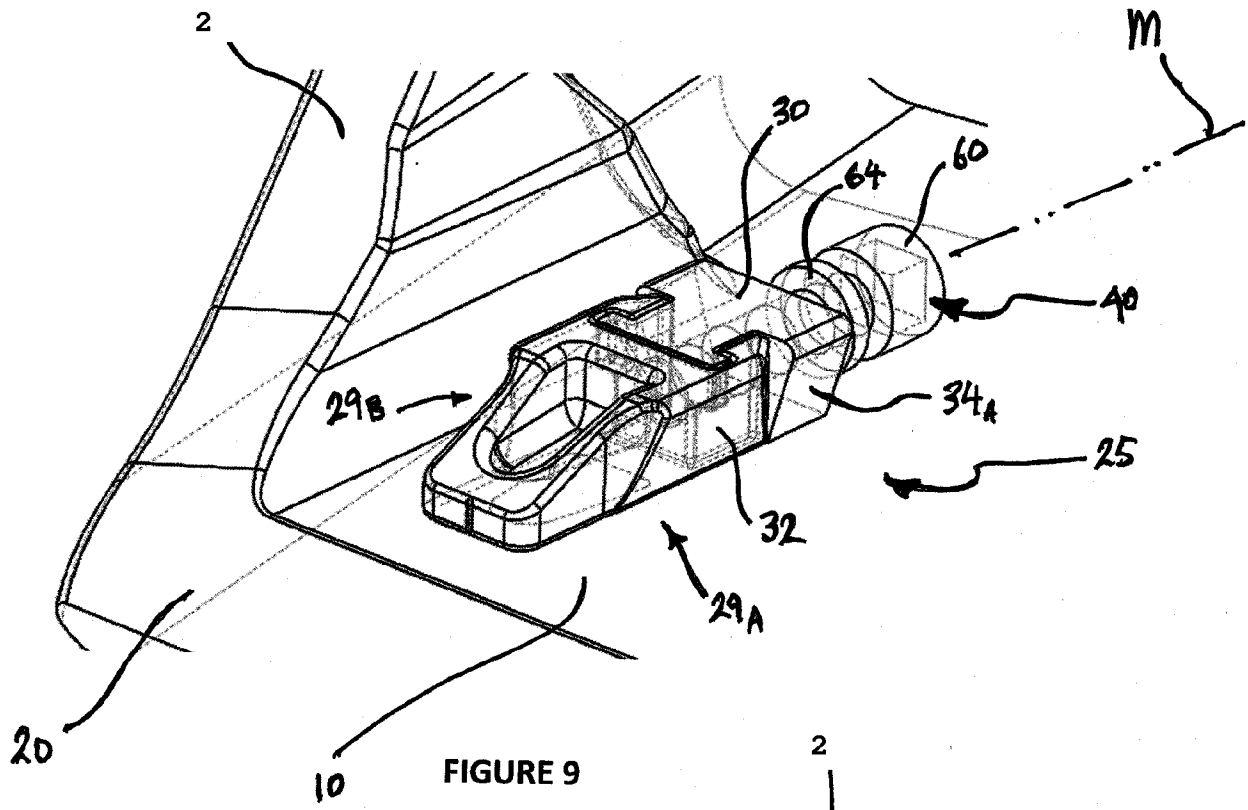

FIGURE 9

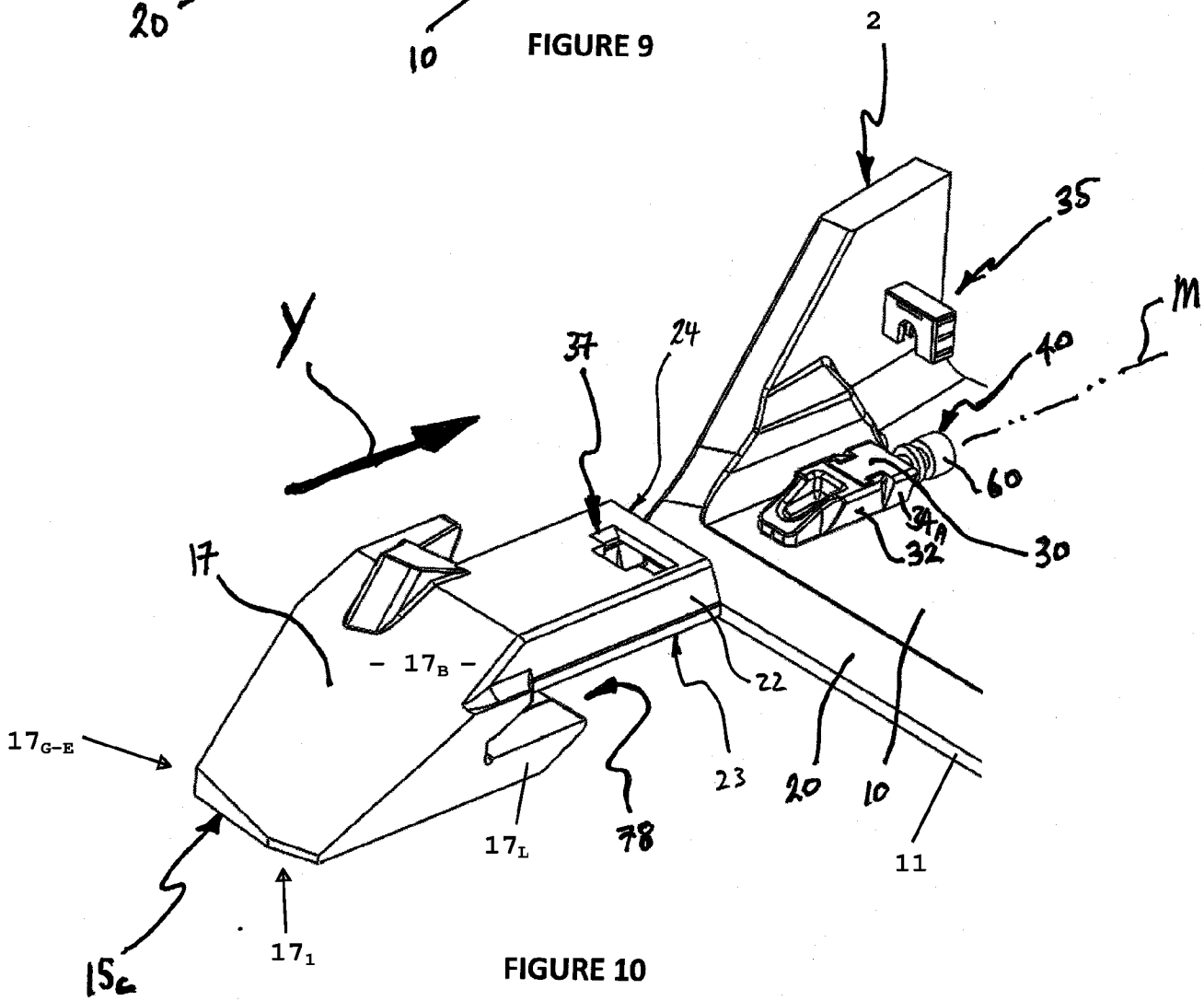

FIGURE 10

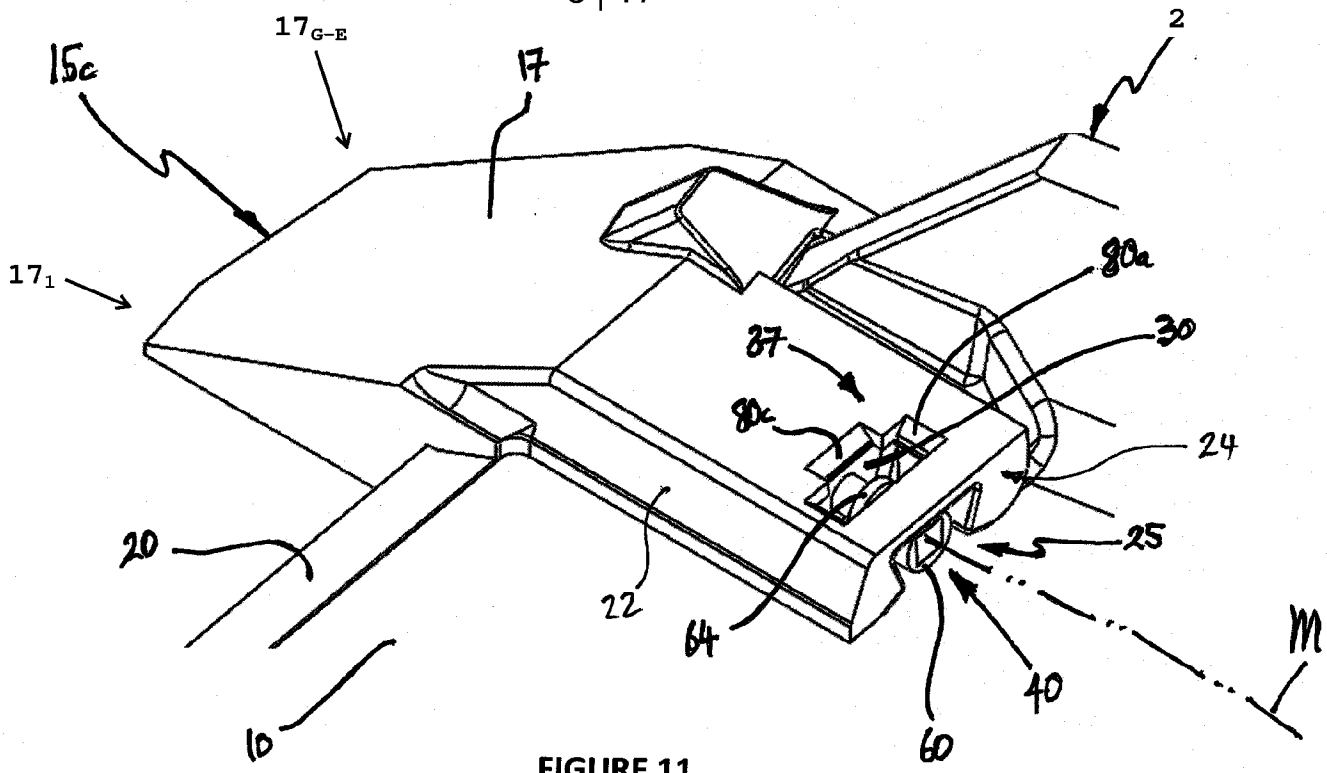

FIGURE 11

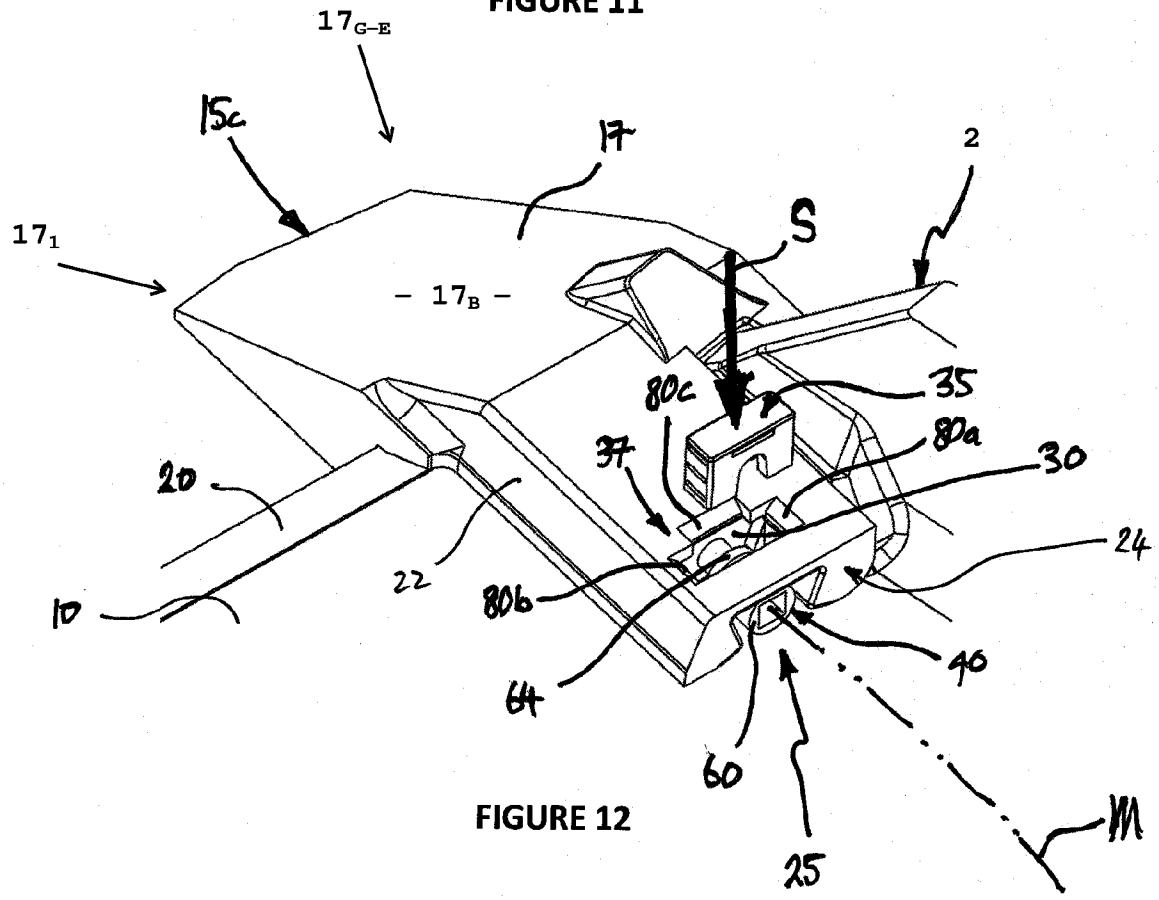

FIGURE 12

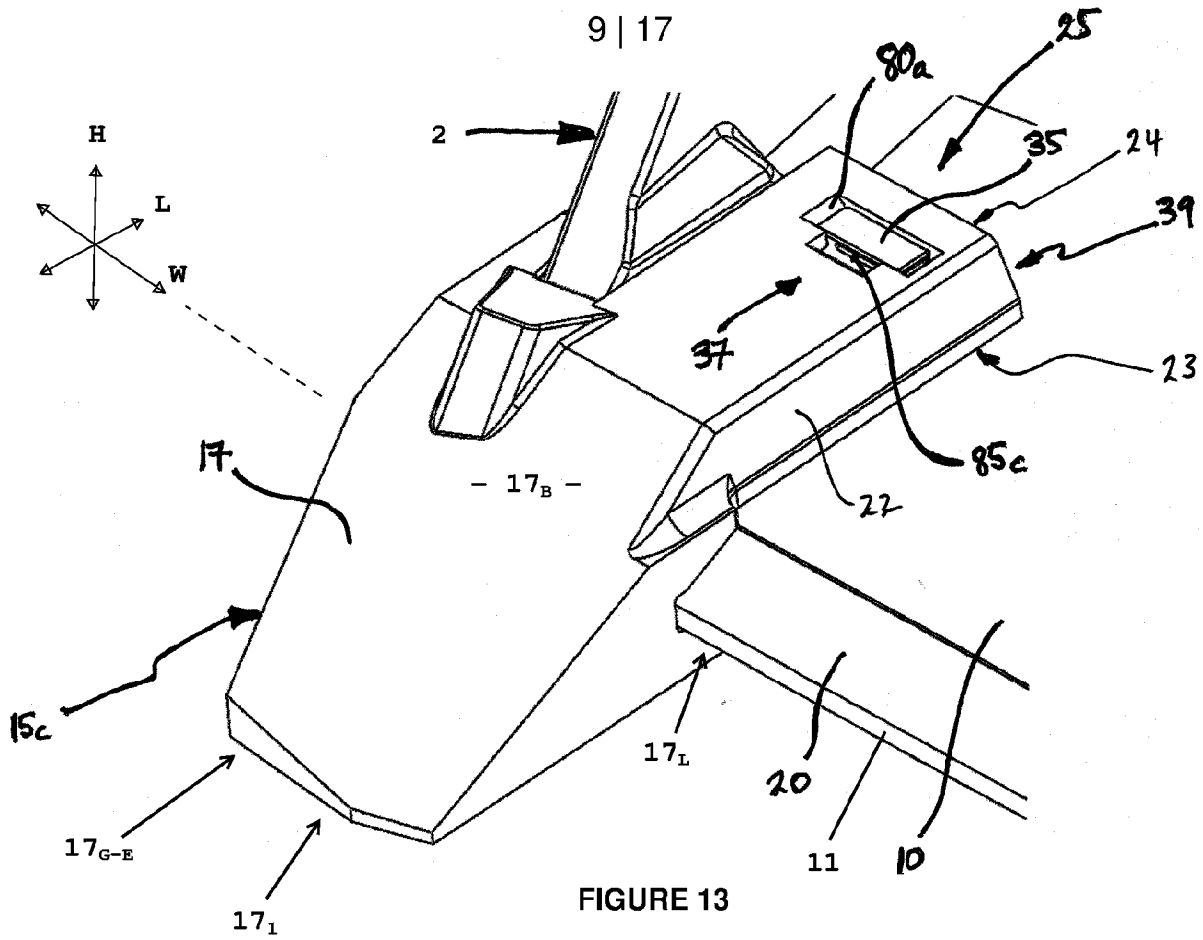

FIGURE 13

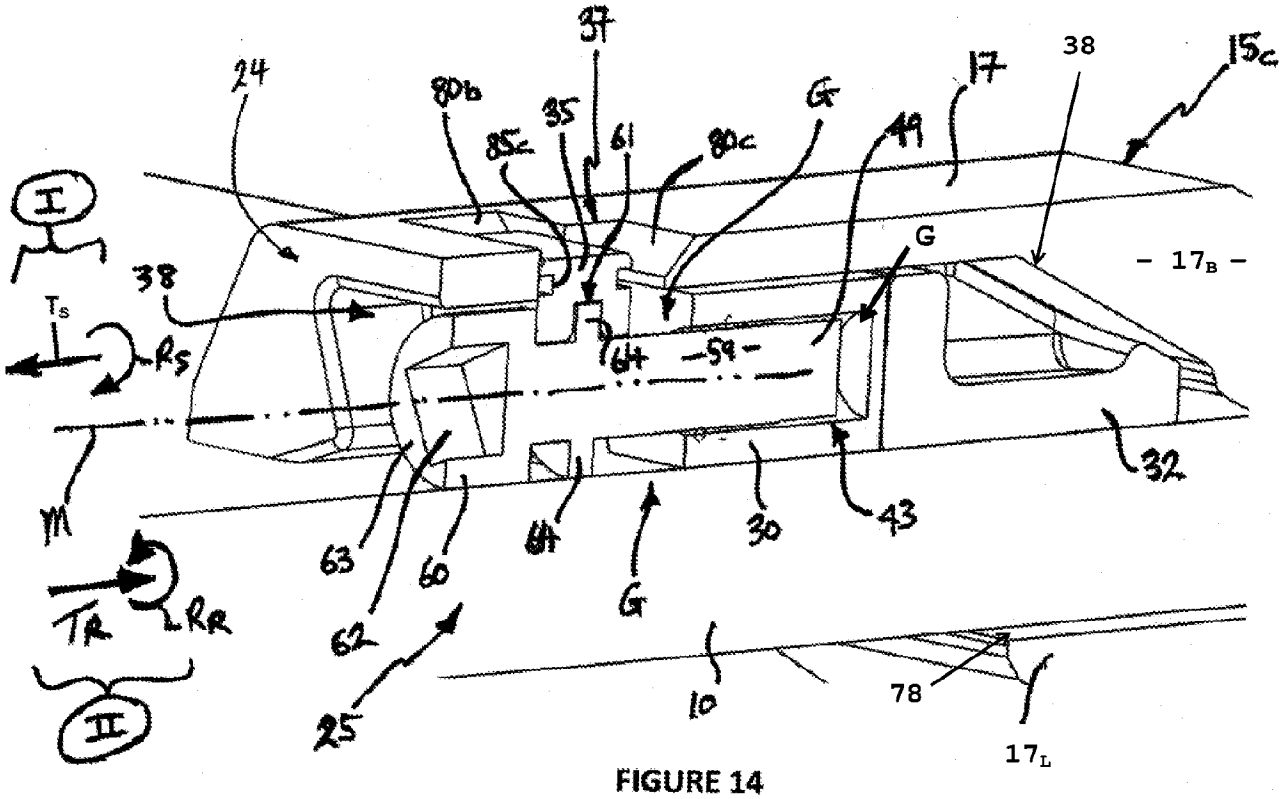

FIGURE 14

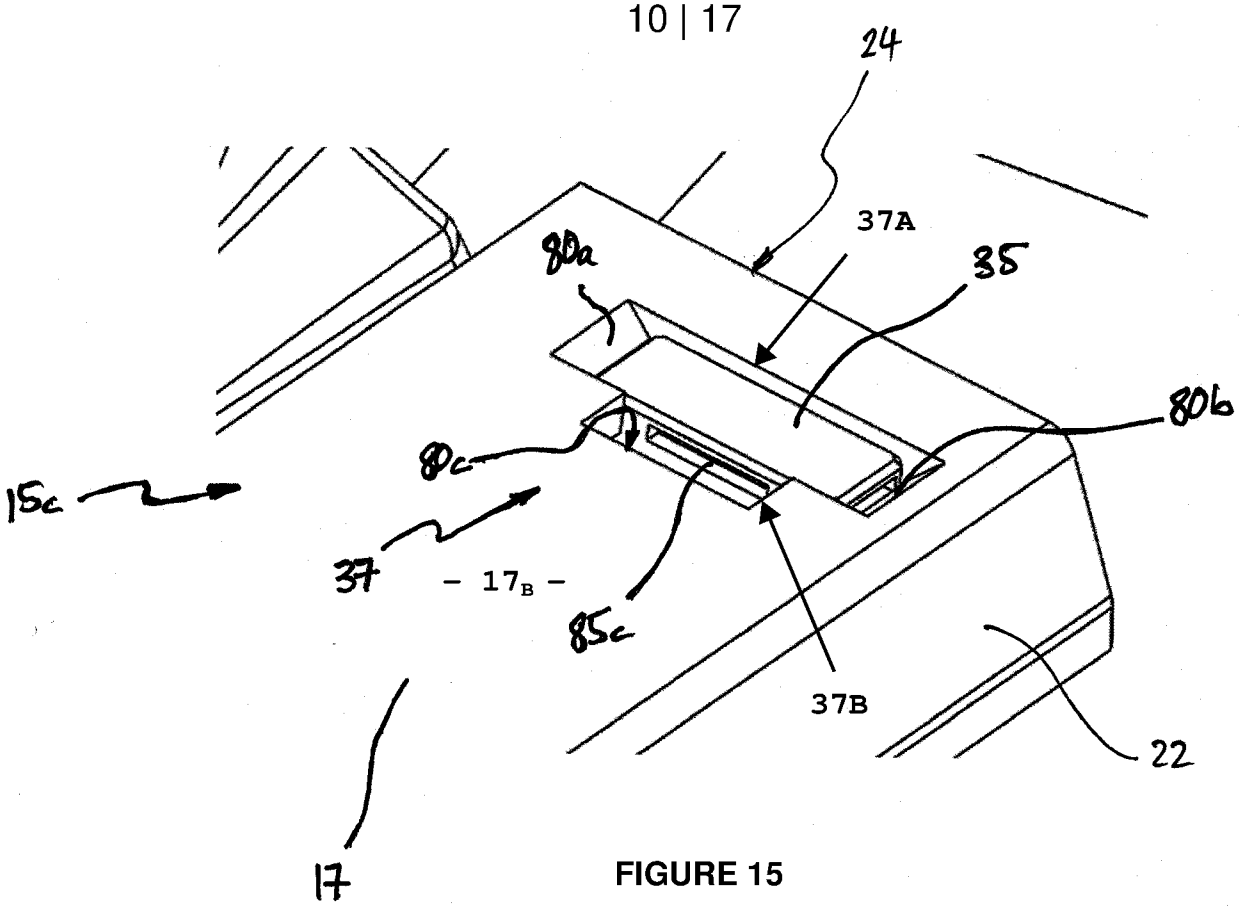

FIGURE 15

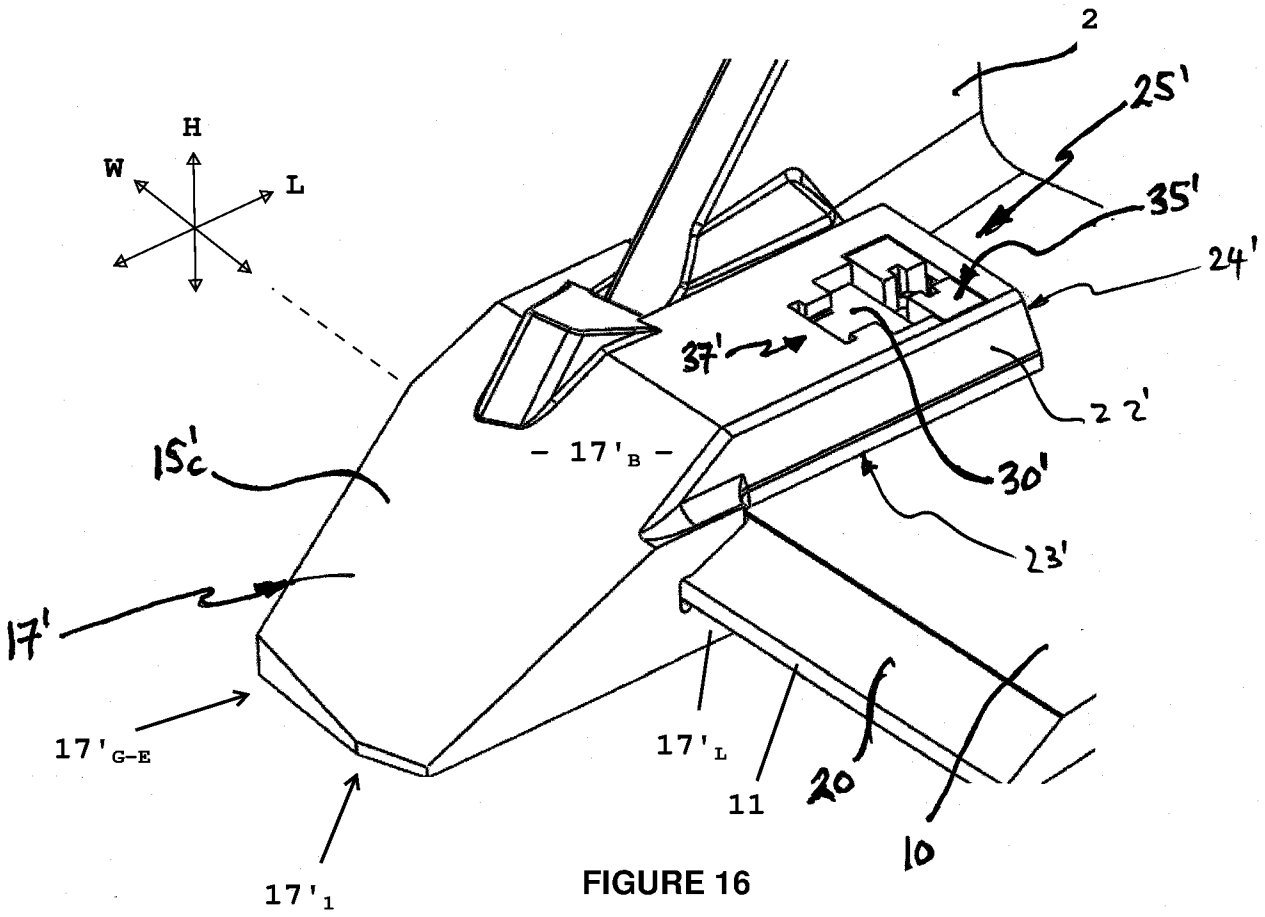

FIGURE 16

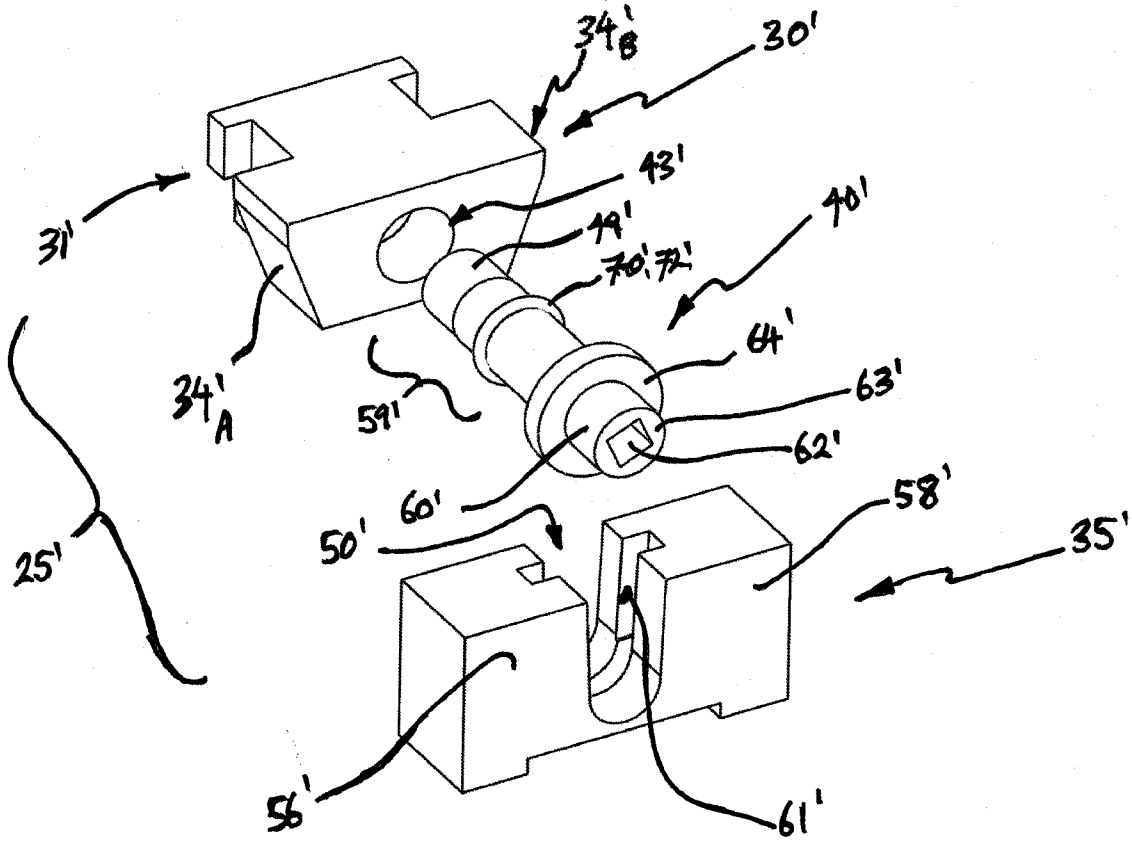

FIGURE 17

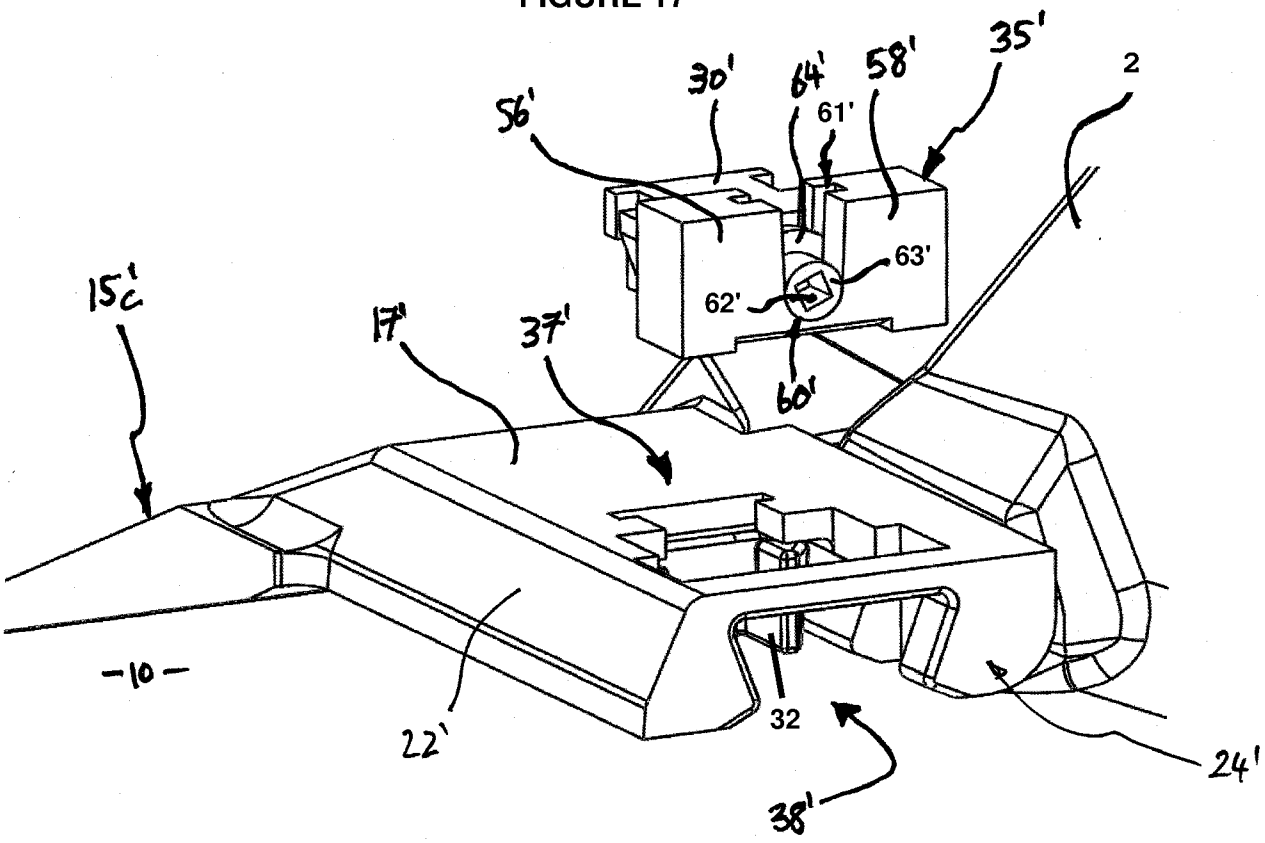

FIGURE 18

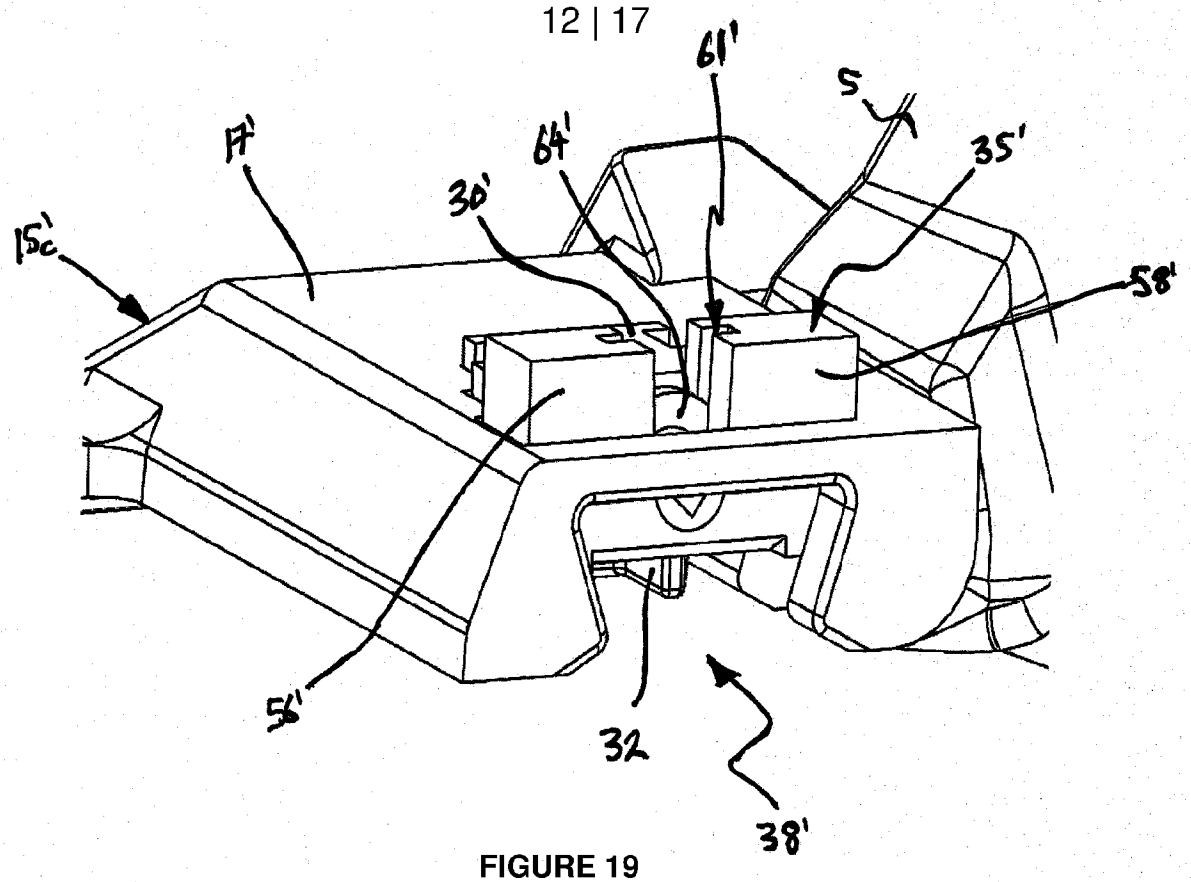

FIGURE 19

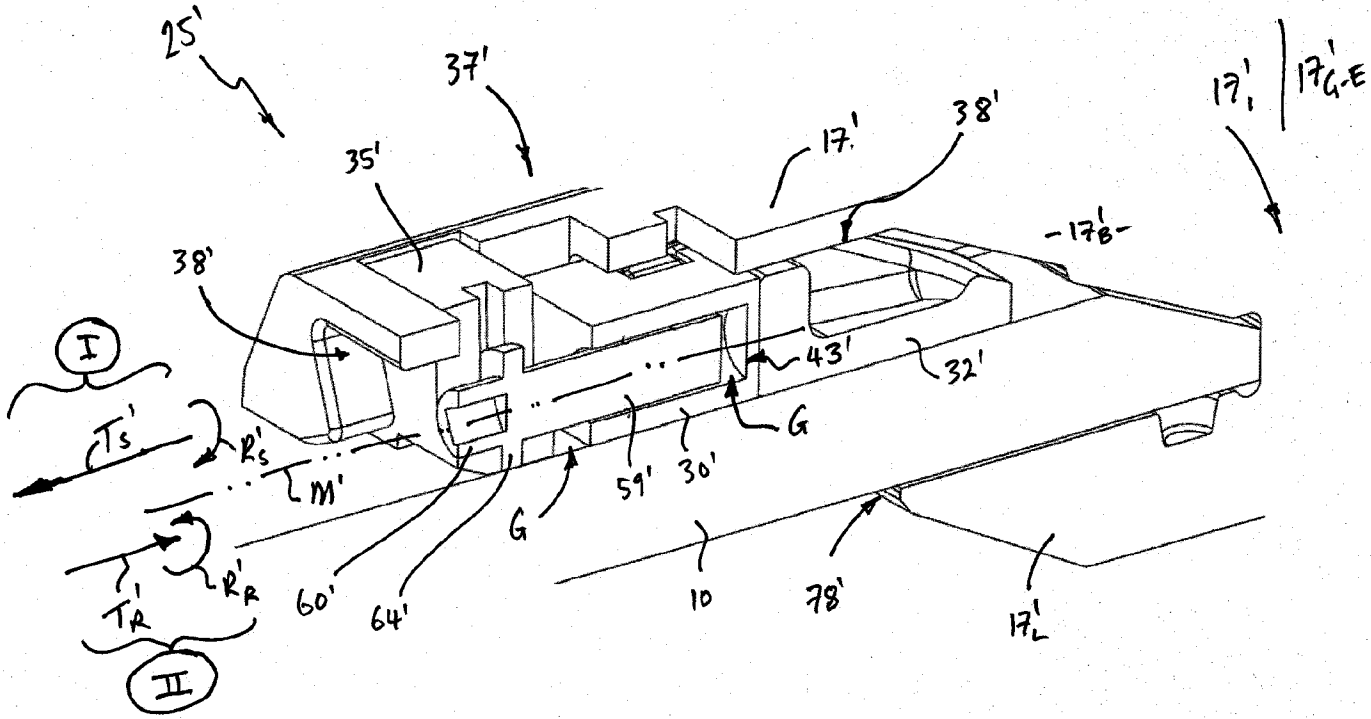

FIGURE 20

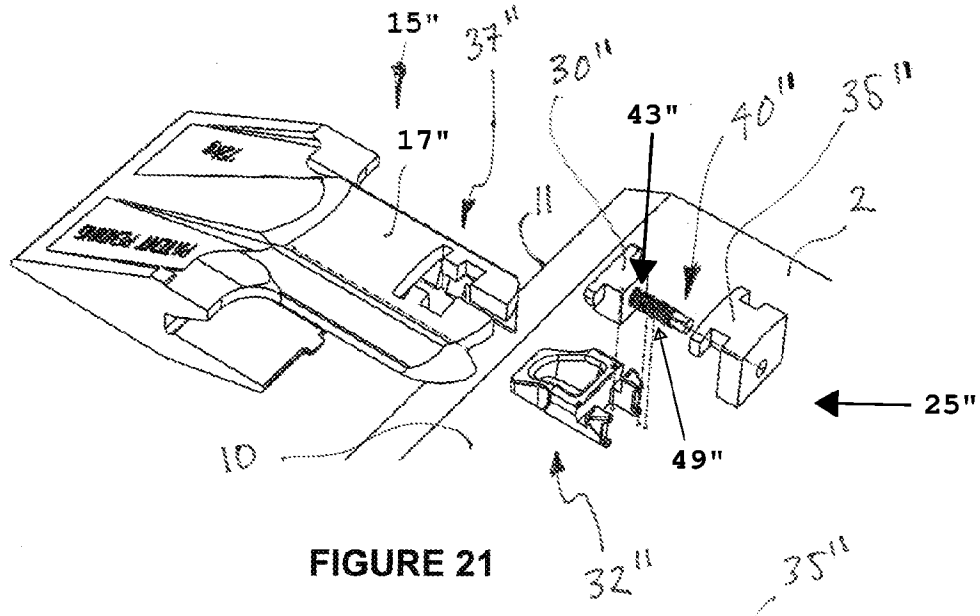

FIGURE 21

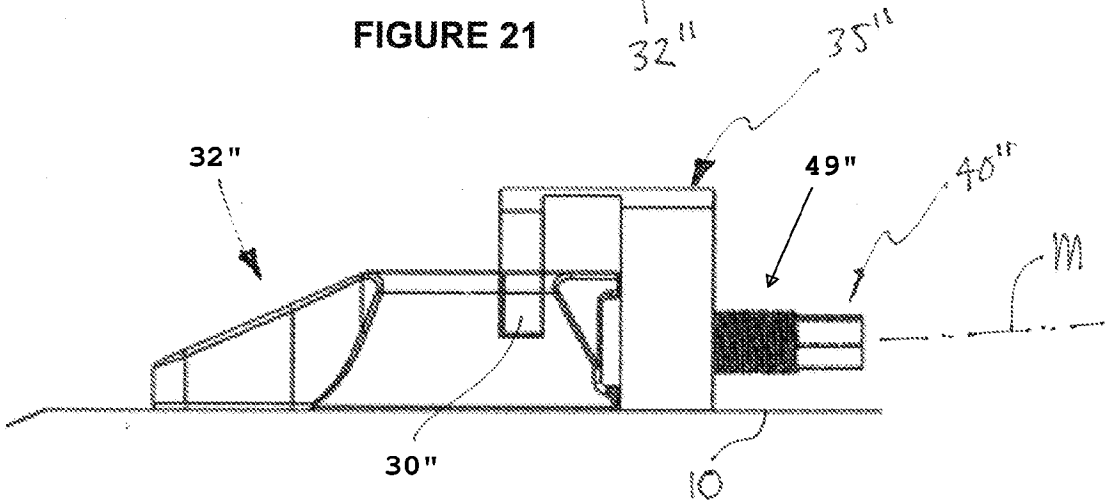

FIGURE 22

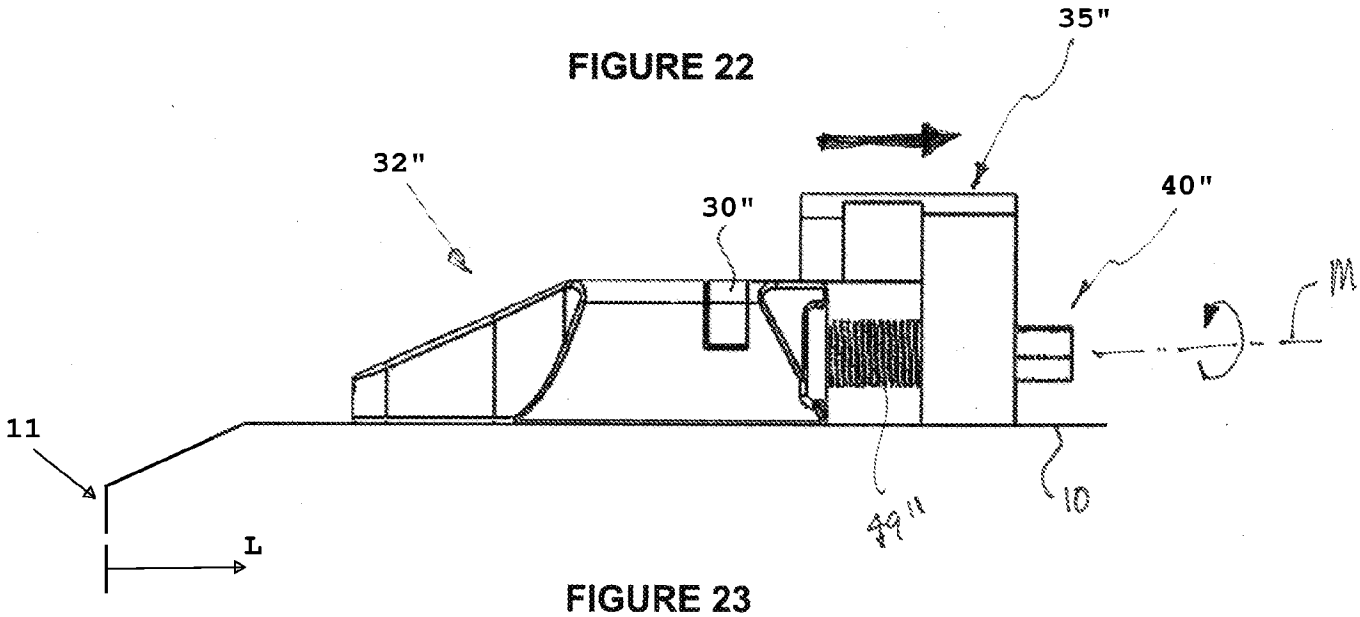

FIGURE 23

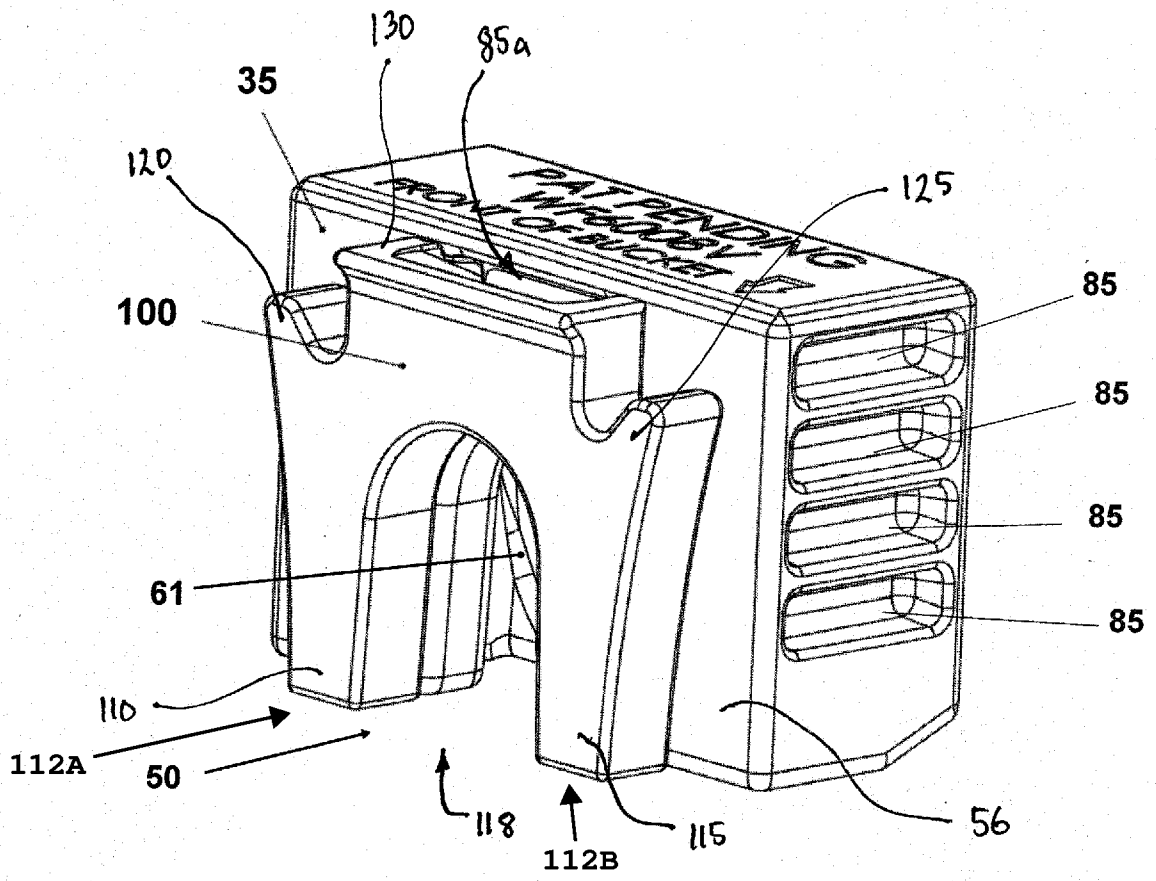

FIGURE 24

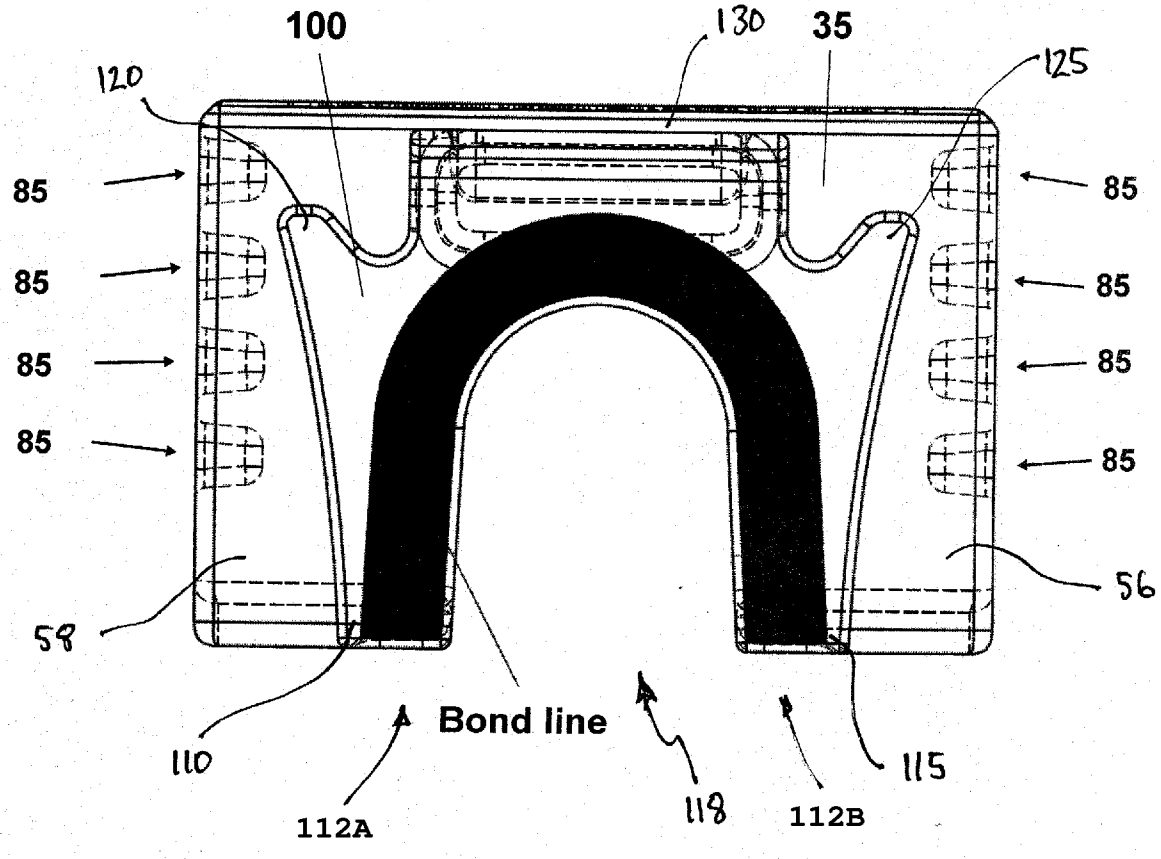

FIGURE 25

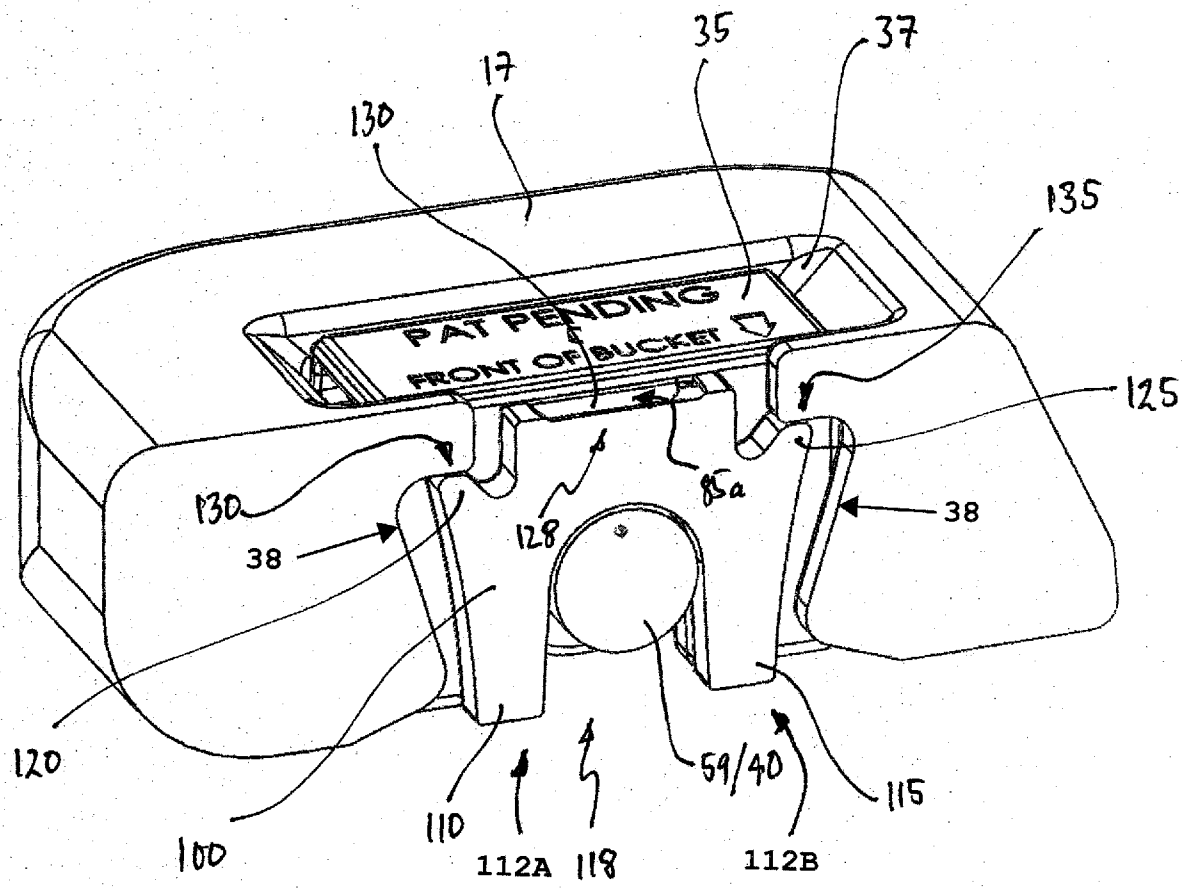

FIGURE 26

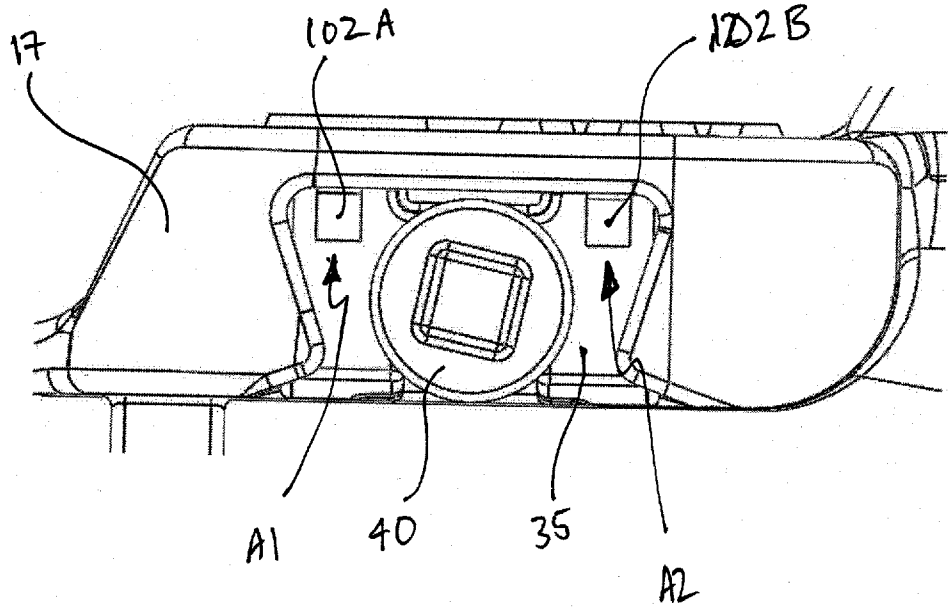

FIGURE 27

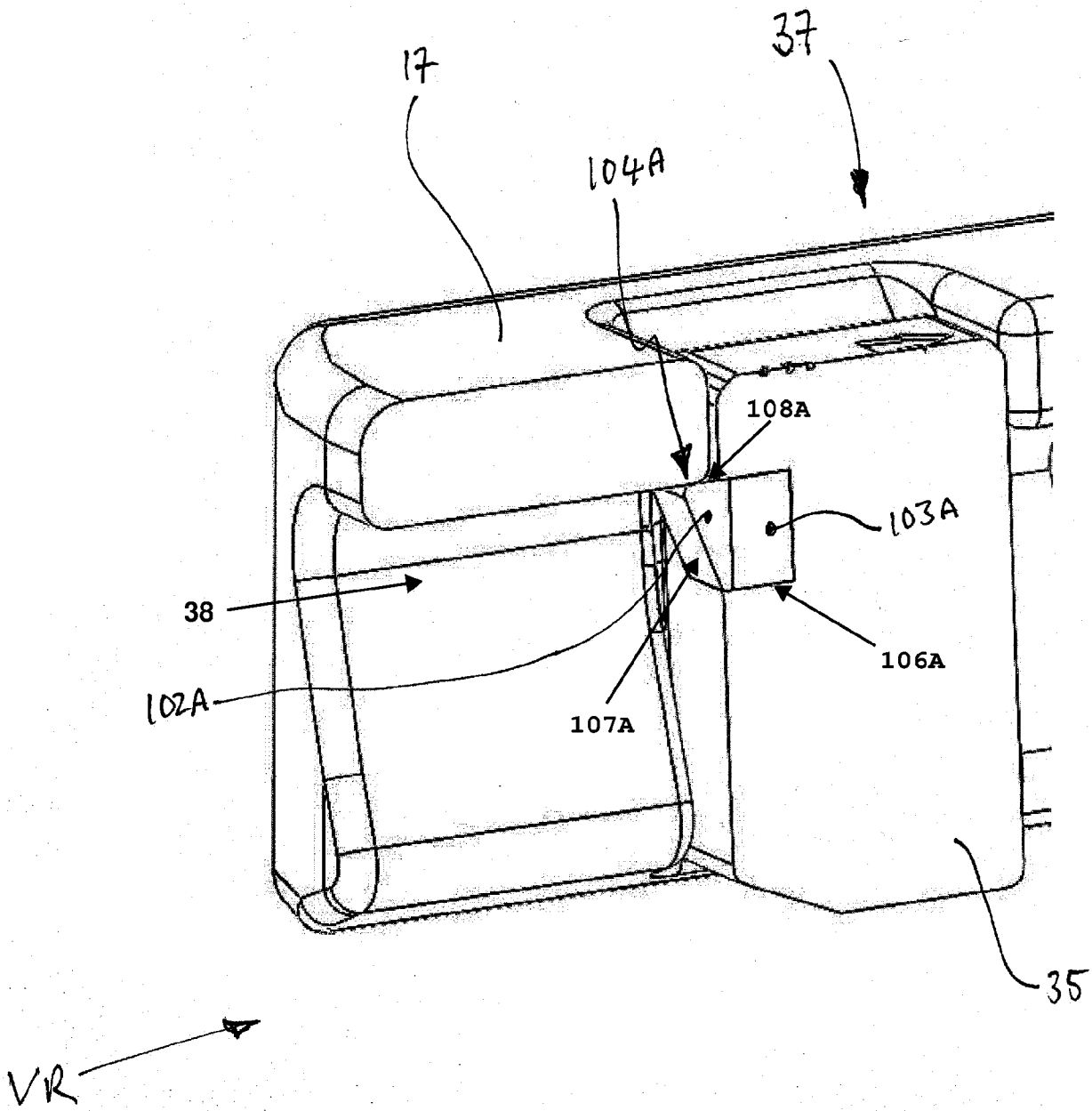

FIGURE 28

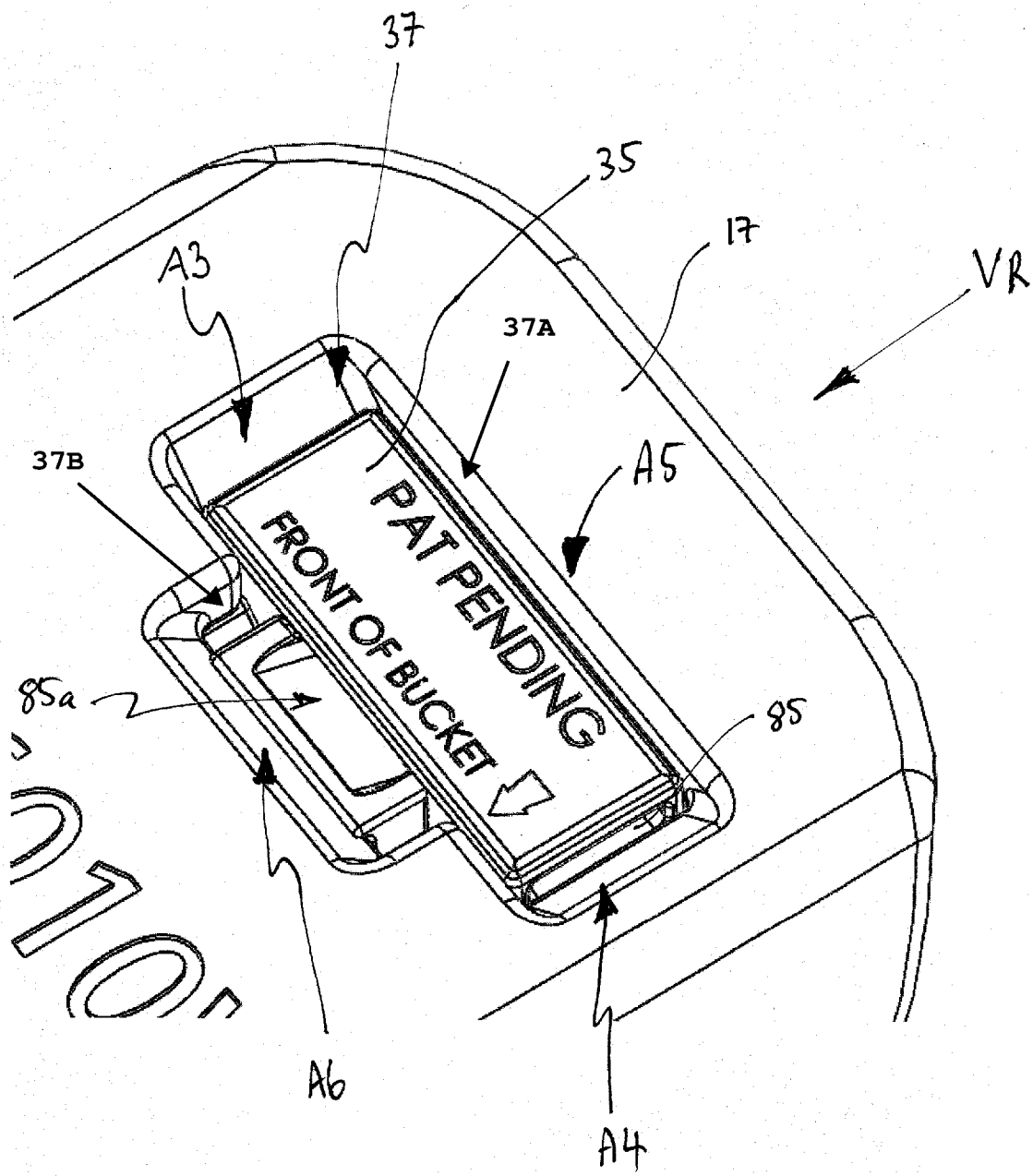

FIGURE 29