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(54) **SHOCK-ABSORBING HAMMER**

(57) A shock absorbing or dead-blow hammer is disclosed for driving nails and striking various objects that reduces the recoil and vibration caused by the hammer blow. The hammer-head (104) is pivoted to the hammer handle (102) and is further connected to the handle (102) by a shock-absorbing mechanism (114).

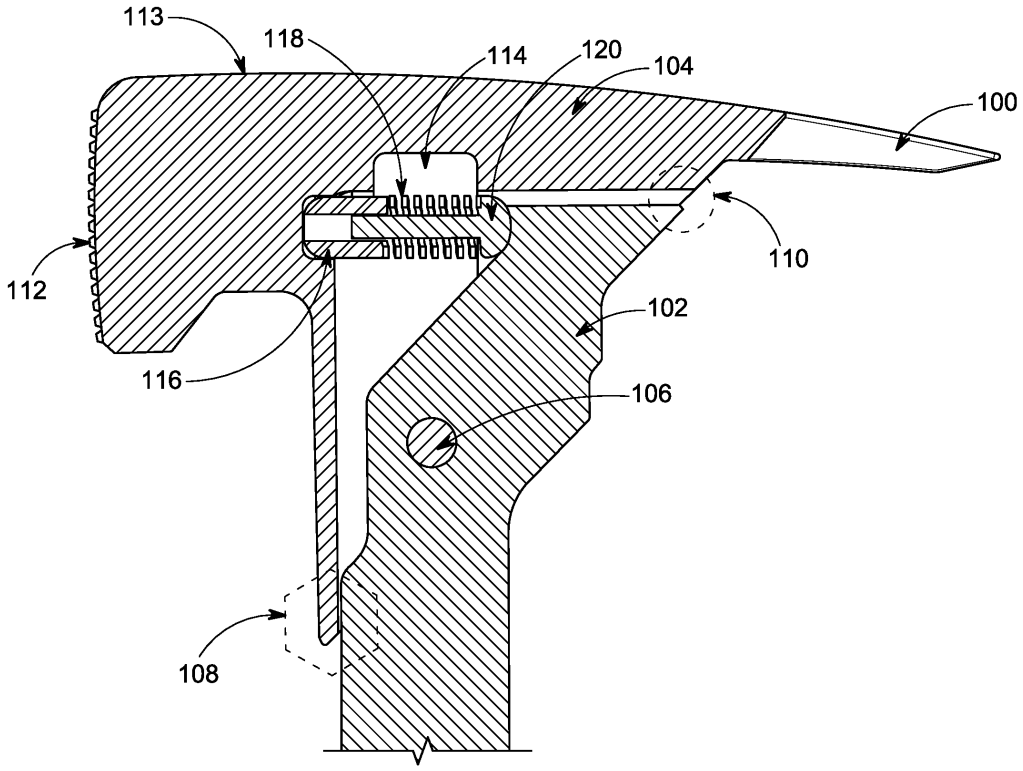

FIG. 1

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Description

Cross-Reference(s) to Related Application(s)

[0001] None.

Technical Field

[0002] This application relates generally to hand tools. More specifically, this application relates to a non-powered hammer capable of absorbing and/or damping the impact shock before reaching the user's hand.

Brief Description of the Drawings

[0003] The drawings, when considered in connection with the following description, are presented for the purpose of facilitating an understanding of the subject matter sought to be protected.

FIGURE 1 shows a cross-sectional view of an example shock-absorbing hammer;
FIGURE 2 shows an isometric exploded view of an example shock-absorbing hammer;
FIGURE 3 shows some details of the example shock-absorbing hammer-head of FIGURE 2;
FIGURE 4 shows an isometric view of the hammer of FIGURE 2 in assembled form.
FIGURE 5 shows a cross-sectional view of another example shock-absorbing hammer;
FIGURE 6 shows a cross-sectional view of another example shock-absorbing hammer with an adjustable shock-absorbing mechanism; and
FIGURE 7 shows another example of a shock-absorbing hammer-head that can replace the hammer-head of FIGURE 2.

Detailed Description

[0004] While the present disclosure is described with reference to several illustrative embodiments and example devices described herein, it should be clear that the present disclosure should not be limited to such embodiments. Therefore, the description of the embodiments provided herein is illustrative of the present disclosure and should not limit the scope of the disclosure as claimed. In addition, it will be appreciated that the disclosure may be applicable with other types of hammer configurations.

[0005] When a tool, such as a hammer, strikes the surface of an object, part of the energy produced by the blow is used to perform the intended work (for example, taking out a nail), part becomes heat, and part is dissipate through the hammer. The energy that is dissipated through the hammer often produces inconvenient results, such as recoil of the hammer from the striking surface, or excessive vibration of the hammer. The inconvenient results produced by hammer blows have been a persistent problem for manufacturers of hammers and other percussive tools. Hammers that have minimum rebound or recoil characteristics are sometimes referred to as "dead blow" hammers, impact absorbing hammers or vibration reducing hammers. The terms dead blow, shock absorbers and vibration reducers are reciprocally used in the present disclosure.

[0006] Some previous approaches for absorbing the hammer shock, for example, the use of sliding weights or ears behind the hammering head, is problematic because the weights themselves develop potential energy when the hammer strikes a surface and tends to recede, thus causing inconvenient vibration or oscillation of the hammer. In addition, dead-blow hammers are limited: (i) because the requirement of a hollow chamber causes the size of said hammers to be out of proportion to the weight; and (ii) because, unless a special punch mix is used, the punch is often not useful in preventing recoil of the hammer. An object of the present disclosure is to overcome these and other limitations of the prior art.

[0007] Briefly described, a shock absorbing or dead-blow hammer is disclosed for driving nails and striking various objects. The disclosed hammer reduces the recoil and vibration caused by the hammer blow, preventing a great portion of the blow from reaching the user's hand and wrist. In one of the embodiments, hammer-head is pivoted to the hammer handle while an energy absorbing mechanism, situated between the two parts, affects the movements of the hammer-head with respect to the hammer handle. In various embodiments the energy absorbing mechanism may utilize friction as a means to dissipate the shock energy and in other embodiments the energy absorbing mechanism may resemble an automobile shock-absorbers. In other embodiments, after each strike, a spring returns the hammer-head to its default or rest position.

[0008] An important advantage of the design of this disclosure is that the hammer-head disclosed here is heavier and therefore more efficient than the hammer-heads in the prior art, for the same size and/or same weight hammers.

[0009] In various embodiments a shock-absorbing hammer may include a hammer-handle, an end of which has a lateral pin hole; a hammer-head, a part of which is a clevis that houses and is pivoted to the end of the hammer-handle by a pin passing through the clevis and the pin hole of the hammer-handle; and a shock-absorbing mechanism, which is installed such that to affect the rotational movements of the hammer-head relative to the hammer-handle and to retard the shocks transferred from the hammer-head to the hammer-handle.

[0010] In other embodiments an efficient shock-retarding hammer may include a hammer-handle; a hammer-head, a part of which is U-shaped and at least a part of the hammer-handle is contained within the U-shaped part of the hammer-head and is pivoted to the U-shaped part by a pin passing through the hammer-handle and the U-shaped part of the hammer-head; and a shock-retarding

component that is placed between the hammer-head and the hammer-handle such that to hamper transfer of all or some vibrations or frequencies from the hammer-head to the hammer-handle.

[0011] In yet other embodiments a blow-back-shock impeding hammer may include a hammer-handle; a hammer-head with a U-shaped part to contain a part of the hammer-handle, where the hammer-handle part within the hammer-head is pivoted to the U-shaped part of the hammer-head and can rotate relative to the hammer-head; and an energy-storing and/or an energy dissipating component that is placed between the hammer-head and the hammer-handle such that to restrict shocks or vibrations generated by the hammer-head and transferred to the hammer-handle.

[0012] Each of the shock-absorbing mechanism or the shock-retarding component or the energy-storing and/or an energy dissipating component can be designed to restrict the transfer of all or some vibrations or frequencies from the hammer-head to the hammer-handle. In another word, these mechanisms and components are mechanical filters that may be designed to stop undesirable vibrations from passing through the filter. These filters may be designed to be adjustable or be replaceable.

[0013] It is to be noted that directions, orientations, and other relative terms such as "front", "back", "top", "bottom", "left", "right", "inside", "outside", "interior", "exterior", "downward", "upward", "front-facing", "down-facing", "vertical", "horizontal", "diagonal", and the like are described with respect or relative to a distinguishing feature of the system or device body itself. For example, if the front part or surface of a system body or an object is identified in the description, then rear or back is defined as the part or surface opposite the front surface, left is defined as the left side when looking into the front surface, and so on. As long as directions are unambiguously identifiable based on the descriptions and figures, how the orientations are defined is immaterial.

[0014] Figure 1 shows a cross-sectional view of an example shock-absorbing hammer-head 104 and part of a hammer handle 102. In some embodiments the hammer-handle 102 itself may be constructed from more than one piece, such as a wooden handle core and a rubber grip. In various embodiments the hammer-head 104 also may have different sections such as a hammer-face 112 for striking a desired object; a hammer-claw 100 for pulling nails; and a magnetic nail holder 113. In various embodiments the disclosed hammers do not need to have a hammer-eye to attach the hammer-head to the hammer-handle, which advantageously adds to the weight of the hammer-head. In this example shock-absorbing hammer, the hammer-head 104 is pinned to the hammer-handle 102 by a pin 106 and can rotationally move with respect to handle 102 in a restricted manner. In a rested or default position, a spring 118 forces the hammer-head 104 to rotate counter-clockwise and stop rotating once it hits the hammer-handle 102 at point 108. Similarly, when hammer-face 112 strikes an object such as a nail head, the hammer-head 104 will rotate clockwise, while depressing spring 118, but stops rotating once it hits the hammer-handle 102 at point 110. Always, at rest, the hammer-head 104 is in contact with the hammer-handle 102 at point 108 but, whether or not the hammer-head 104 contacts the hammer-handle 102 at point 110 depends on the severity of the strike.

[0015] In the example shown in Figure 1, the shock-absorbing assembly 114 comprises a pin 120, a spring 118, and a sleeve 116. In some embodiments there is friction between the pin 120 and sleeve 116 and in the other embodiments the pin 120 moves without friction inside sleeve 116. As can be seen in Figure 1, the head of pin 120 and the tail of sleeve 116 are rounded to help them easily move with respect to handle 102 and hammer-head 104, respectively, whenever the hammer-head 104 rotates around pin 106.

[0016] In a somewhat similar arrangement in US Patent No. 8,438,953 (Patent "'953"), the hammer-handle is U- shaped (clevis or forked connector) at the top to receive, enclose, and house the I-shaped extension of the hammer-head. Because of this design of Patent '953, some weight is unnecessarily subtracted from the hammer-head and is added to the hammer-handle. This needlessly reduces the efficiency of strikes by the hammer.

[0017] In contrast to patent '953, Figure 2 shows an isometric exploded view of an example shock-absorbing hammer, where the hammer-handle 206 is relatively flat at the top and does not fork out, instead, the extension 213 of the hammer-head 200 is forked out (U- shaped, clevis, also called "two-wall clevis") to receive, enclose, and house the hammer-handle 206. Here, the hammer-handle 206 enters the hammer-head 200 in the direction 212 and is pivoted to the hammer-head 200 by the pin set 202 and 204. The shock-absorbing mechanism set 214 is mounted between the hammer-head 200 and the hammer-handle 206. In this embodiment the handle cover or handle grip 208 is an optional component, which can receive the hammer-handle 206 through opening 210 and be removable or permanently attached to it.

[0018] In various embodiments the shock-absorbing mechanism set 214 may be adjustable or be removable and replaceable so that the user can adjust it for filtering certain vibrations or exchange it with another shock-absorbing mechanism more suited for her/his intended job. To adjust or change the shock-absorbing mechanism, the user removes the pin set 202 and 204, adjusts or replaces the mechanism and reinstalls the pin set 202 and 204. In various embodiments a few shock-absorbing mechanism sets may be attached to or housed in the hammer-handle or the handle-grip.

[0019] Figure 3 shows some details of the example shock-absorbing hammer-head of Figure 2. In Figure 3, the hammer-head 200 of Figure 2 is shown from another angle which more clearly illustrates the clevis 302 and the pin-holes 304. As seen in Figure 3, the clevis 302 will add more weight to the hammer-head 200 in comparison

with the flat hammer-head extension of Patent '953. The details of the design and structure of the clevis 302 can be manipulated as desired to be made bulkier and add to the mass of the hammer-head. The mass of the hammer-head in Patent '953 cannot be changed as much as the hammer-head disclosed in this specification. For example for the same size and dimension hammers, the hammer-head of the present disclosure can be made heavier than the hammer-head in Patent '953.

[0020] Figure 4 shows isometric view of an example disclosed shock-absorbing hammer 400. This hammer is the assembled combination of the parts shown in Figure 2. As seen in Figure 4, the hammer-head 404 has housed and is pivoted by pin 402 to the hammer-handle 412 which itself is housed within the optional handle-grip 406. In this example embodiment, the hammer-head 404 has a magnetized nail holder 410. Furthermore, in this embodiment the shock-absorbing mechanism 408 can be seen from outside of the hammer-head 404. In other embodiments the shock-absorbing mechanism 408 may be covered by an opaque or a clear component of the hammer-head. In some embodiments the shock-absorbing mechanism 408 may be adjustable through the mentioned opening without the need to remove the hammer-head 404 from the hammer-handle 412.

[0021] In the example shown in Figure 5, the shock-absorbing assembly 506 is again acting between the pivoted hammer-head 504 and the hammer-handle 502, but it is located at a different position compared to the one shown in Figure 1. Similarly, in various embodiments, the shock-absorbing assembly may be placed in different positions between the pivoted hammer-head and the hammer-handle. Different positions of the shock-absorbing assembly can offer different advantages such as ease of manufacturing of the hammer-head, the hammer-handle, and/or the shock-absorbing assembly or even offer more pronounced shock-depleting effect.

[0022] Figure 6 shows a cross-sectional view of another example shock- retarding hammer with an adjustable shock- retarding mechanism. In this embodiment, the example shock-retarding mechanism that includes a threaded pin 610, a sleeve 606, a spring 608, and an adjustment nut 612, are positioned between the hammer-head 604 and the hammer-handle 602. As seen in Figure 6, the adjustment nut 612 is approachable from outside of the hammer without the need to separate the hammer-head 604 from the hammer-handle 602. By turning the adjustment nut 612, a user can vary the pre-stressed force of the spring 608 and effectively change the characteristics of the shock-retarding mechanism or the mechanical filter. It is easy to see that by completely compressing the spring 608, the user can fix the hammer-head 604 to the hammer-handle 602 and make it a regular or traditional hammer, if desired. In other example embodiments if, for example, an air-based or a gas-based shock-absorber is used, a similar adjustment may be provided to widen or restrict the gas or the air passage and, again, effectively change the characteristics of the shock-absorber or the mechanical filter. Here also, the opening or closing of the gas or the air passage will have extreme effects on the mechanical filter and in turn on the behavior of the hammer.

[0023] Figure 7 shows another example of a shock-absorbing hammer-head 700 that can replace the hammer-head 200 of Figure 2. As illustrated and described in detail above, the hammer-head 200 of Figure 2 has a clevis 213 with two walls, in between which the hammer-handle 206 is retained and to which walls the hammer-handle 206 is pivoted by the pin set 202 and 204. In Figure 7; however, the hammer-head 700 has a single wall 701 ("single-wall clevis") that is somewhat similar to one of the walls of clevis 213 (clevis 213 is shown more clearly in Figure 3). The hammer-handle 206 can likewise be pivoted to the hammer-handle 206 by a pin set similar to the pin set 202 and 204. And again, the design details of the structure of the wall 701 can also be manipulated as desired to be made bulkier and increase the mass of the hammer-head 700.

[0024] Changes can be made to the claimed invention in light of the above Detailed Description. While the above description details certain embodiments of the invention and describes the best mode contemplated, no matter how detailed the above appears in text, the claimed invention can be practiced in many ways. Details of the system may vary considerably in its implementation details, while still being encompassed by the claimed invention disclosed herein.

[0025] Particular terminology used when describing certain features or aspects of the disclosure should not be taken to imply that the terminology is being redefined herein to be restricted to any specific characteristics, features, or aspects of the disclosure with which that terminology is associated. In general, the terms used in the following claims should not be construed to limit the claimed invention to the specific embodiments disclosed in the specification, unless the above Detailed Description section explicitly defines such terms. Accordingly, the actual scope of the claimed invention encompasses not only the disclosed embodiments, but also all equivalent ways of practicing or implementing the claimed invention.

[0026] It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as "open" terms (e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.). It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce

claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (e.g., "a" and/or "an" should typically be interpreted to mean "at least one" or "one or more"); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean at least the recited number (e.g., the bare recitation of "two recitations," without other modifiers, typically means at least two recitations, or two or more recitations). Furthermore, in those instances where a convention analogous to "at least one of A, B, and C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, and C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to "at least one of A, B, or C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, or C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase "A or B" will be understood to include the possibilities of "A" or "B" or "A and B." It is further understood that any phrase of the form "A/B" shall mean any one of "A", "B", "A or B", or "A and B". This construct includes the phrase "and/or" itself.

[0027] The above specification, examples, and data provide a complete description of the manufacture and use of the claimed invention. Since many embodiments of the claimed invention can be made without departing from the spirit and scope of the disclosure, the invention resides in the claims hereinafter appended. It is further understood that this disclosure is not limited to the disclosed embodiments, but is intended to cover various arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.

Claims

1. A shock-absorbing hammer comprising:

   a hammer-handle, an end of which has a lateral pin hole;
   a hammer-head, a part of which is a one-wall or two-wall clevis, wherein the clevis is pivoted to the end of the hammer-handle by a pin passing through the clevis and the pin hole of the hammer-handle; and
   a shock-absorbing mechanism, wherein the shock-absorbing mechanism is placed such that to affect the rotational movements of the hammer-head relative to the hammer-handle.

2. The shock-absorbing hammer of claim 1, wherein the shock-absorbing mechanism is comprised of a pin, a sleeve, and a spring.

3. The shock-absorbing hammer of claim 1, wherein the shock-absorbing mechanism is comprised of a pin, a sleeve, and a spring and energy is dissipated by friction between the pin and the sleeve.

4. The shock-absorbing hammer of claim 1, wherein the shock-absorbing mechanism is an oil-based shock absorber; or

   wherein the shock-absorbing mechanism is a gas-based shock absorber; or
   wherein the shock-absorbing mechanism is an air-based shock absorber.

5. The shock-absorbing hammer of claim 1, wherein the hammer-handle has a storage part to store at least one other shock-absorbing mechanism.

6. The shock-absorbing hammer of claim 1, wherein the shock-absorbing mechanism can be dismounted and be exchanged with a different shock-absorbing mechanism for different purposes.

7. An efficient shock-retarding hammer comprising:

   a hammer-handle;
   a hammer-head, a part of which is U-shaped, wherein at least a part of the hammer-handle is contained within the U-shaped part and is pivoted to the U-shaped part by a pin passing through the hammer-handle and the U-shaped part of the hammer-head; and
   a shock-retarding component, wherein the shock-retarding component is placed between the hammer-head and the hammer-handle such that to hamper transfer of any shock from the hammer-head to the hammer-handle.

8. The efficient shock-retarding hammer of claim 7, further comprising a space in the hammer-handle to store at least one other shock- retarding component.

9. The efficient shock-retarding hammer of claim 7, wherein the shock- retarding component can be dismounted and be exchanged with a different shock-retarding component for different purposes.

10. The efficient shock-retarding hammer of claim 7, wherein the shock-retarding component is comprised of a pin, a sleeve, and a spring; or wherein

the shock- retarding component is comprised of a pin, a sleeve, and a spring and energy is dissipated by friction between the pin and the sleeve; or wherein
the shock- retarding component is an oil-based or and air-based or a gas-based shock absorber.

11. A blow-back-shock impeding hammer comprising:

a hammer-handle;
a hammer-head with a U-shaped part to contain a part of the hammer-handle, wherein the hammer-handle part within the hammer-head is pivoted to the U-shaped part of the hammer-head and can rotate relative to the hammer-head; and
an energy-storing and/or an energy dissipating component, wherein the component is placed between the hammer-head and the hammer-handle such that to restrict shocks generated by the hammer-head and transferred to the hammer-handle.

12. The blow-back-shock impeding hammer of claim 11, further comprising a space in the hammer-handle to store at least one other energy-storing and/or an energy dissipating component.

13. The blow-back-shock impeding hammer of claim 11, wherein the energy-storing and/or an energy dissipating component can be dismounted and be exchanged with a different energy-storing and/or an energy dissipating component for different purposes.

14. The blow-back-shock impeding hammer of claim 11, wherein the energy-storing and/or an energy dissipating component is comprised of a pin, a sleeve, and a spring; or wherein

the energy-storing and/or an energy dissipating component is comprised of a pin, a sleeve, and a spring and energy is dissipated by friction between the pin and the sleeve; or wherein.
the energy-storing and/or an energy dissipating component is an oil-based or and air-based or a gas-based shock absorber.

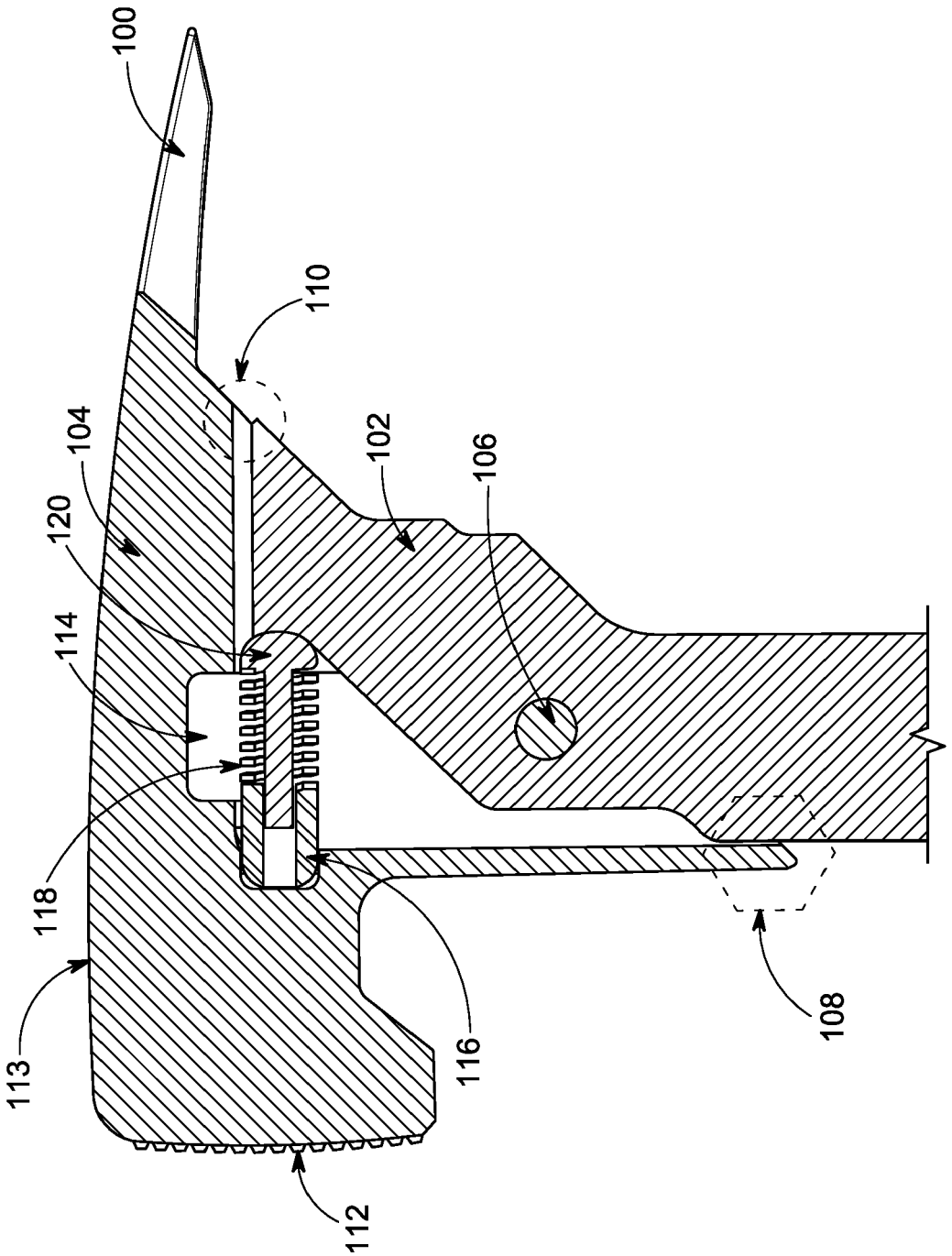

FIG. 1

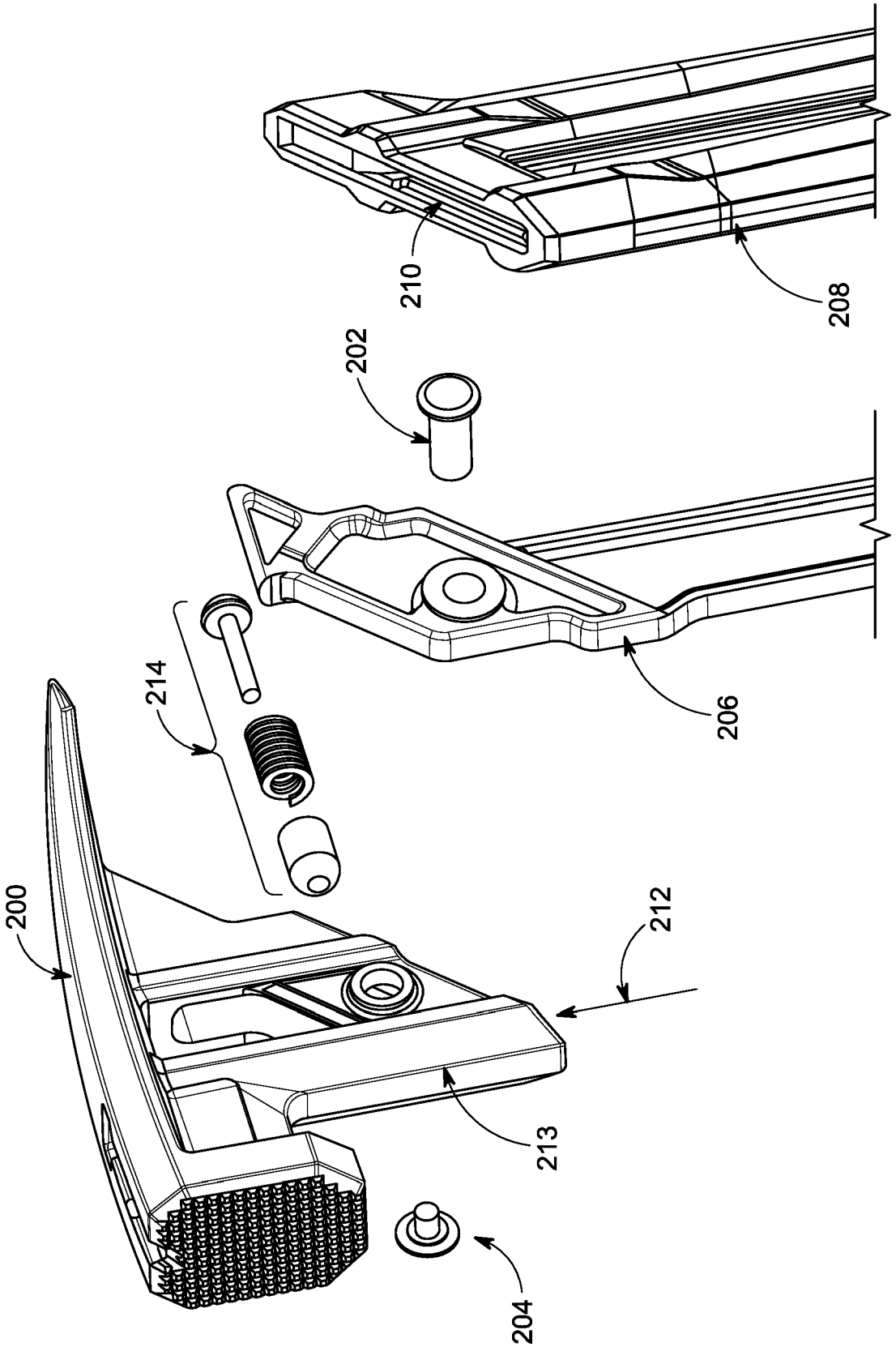

FIG. 2

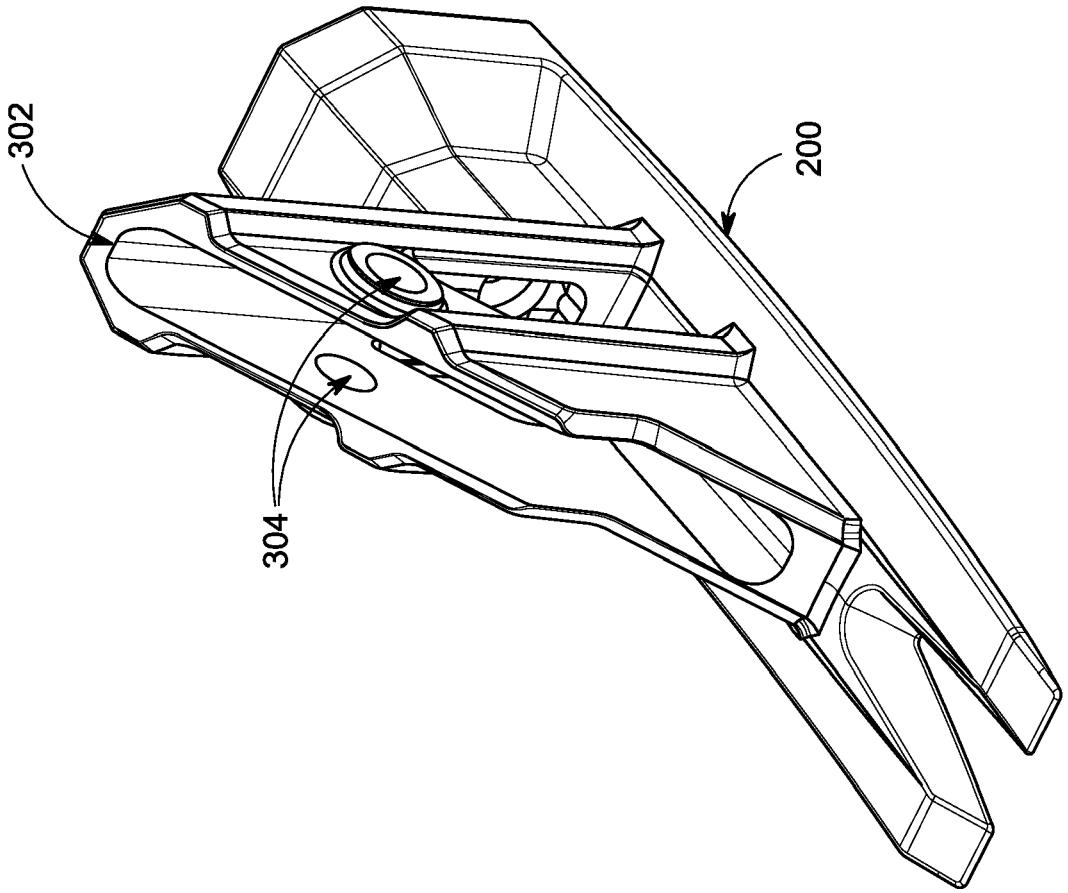

FIG. 3

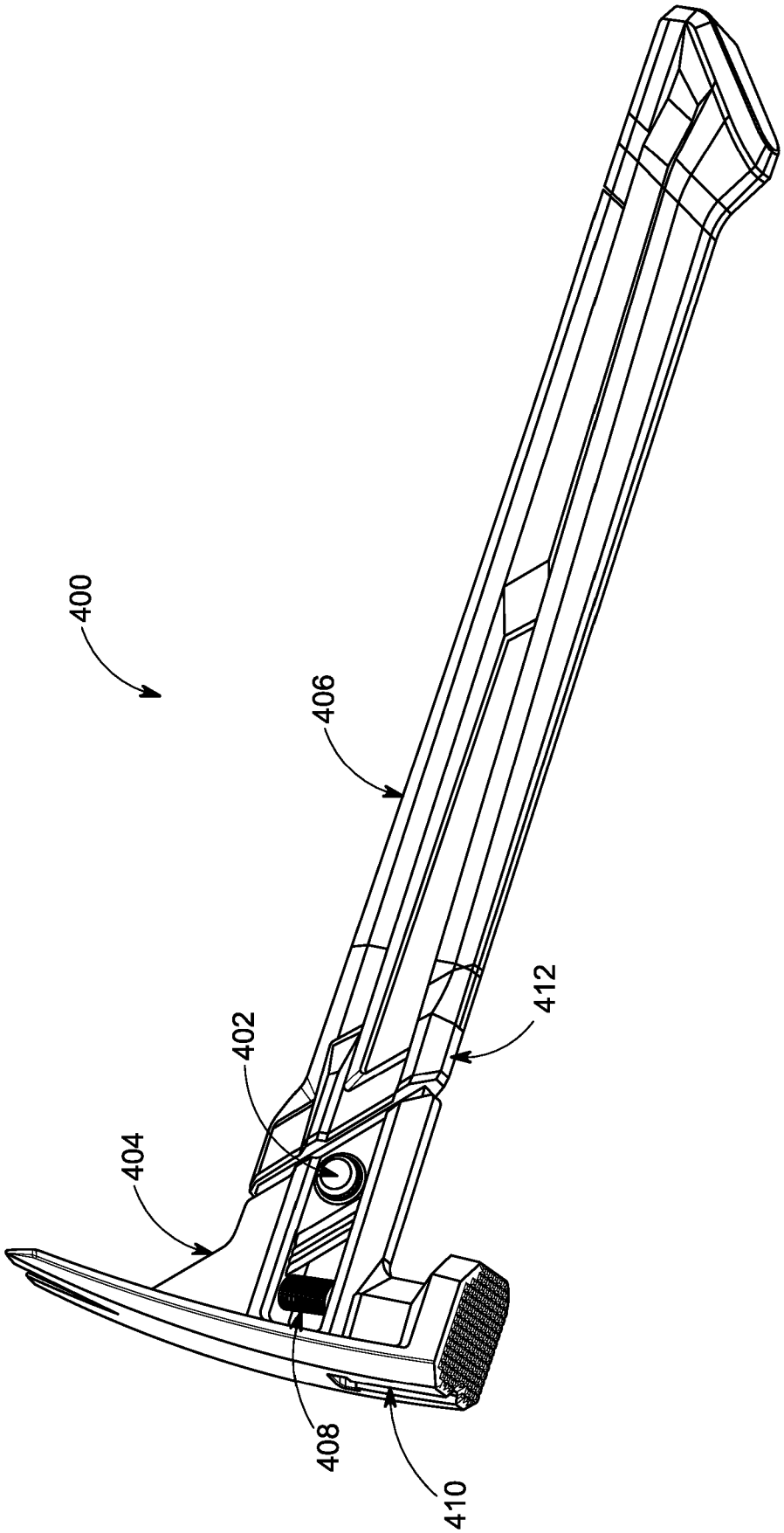

FIG. 4

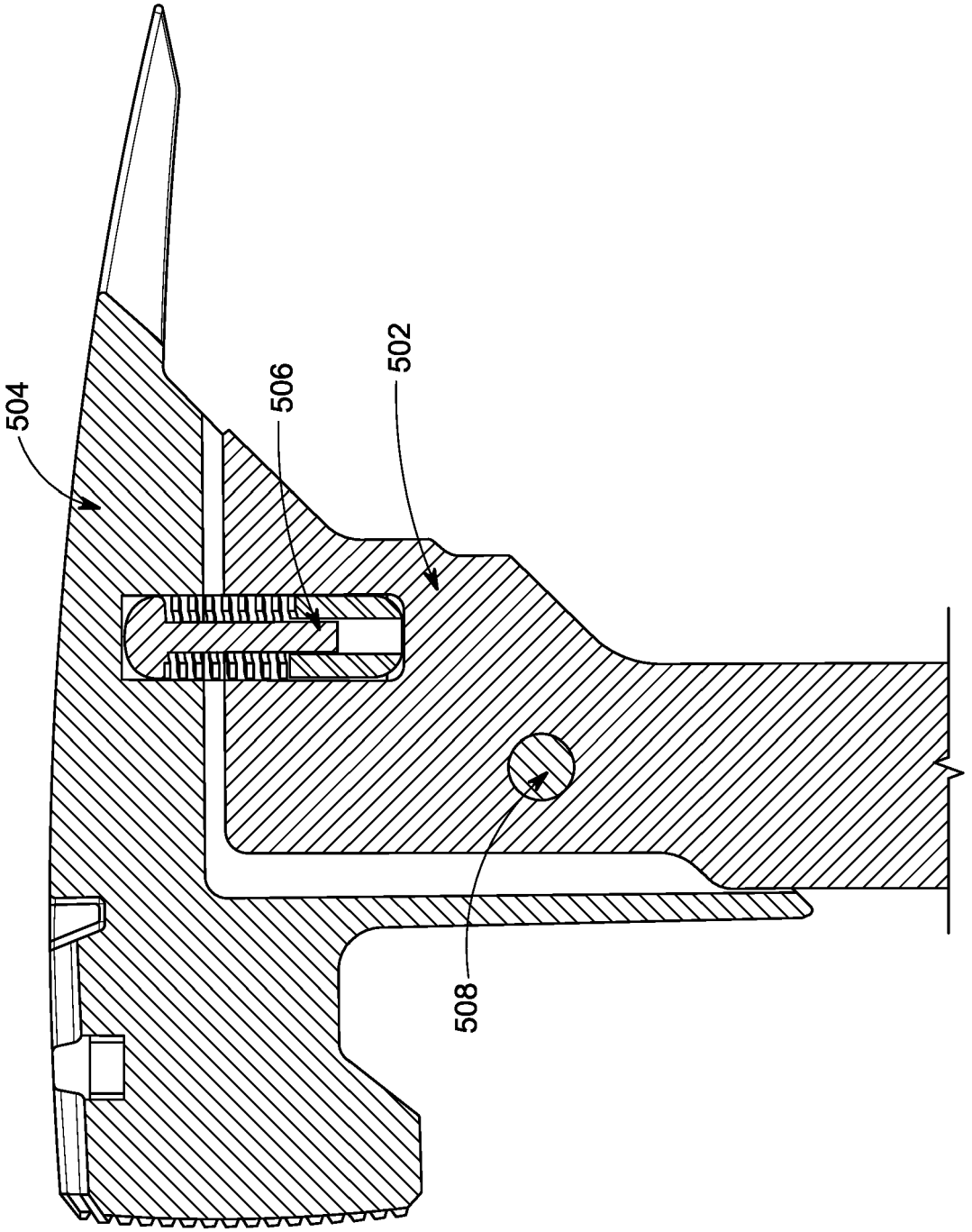

FIG. 5

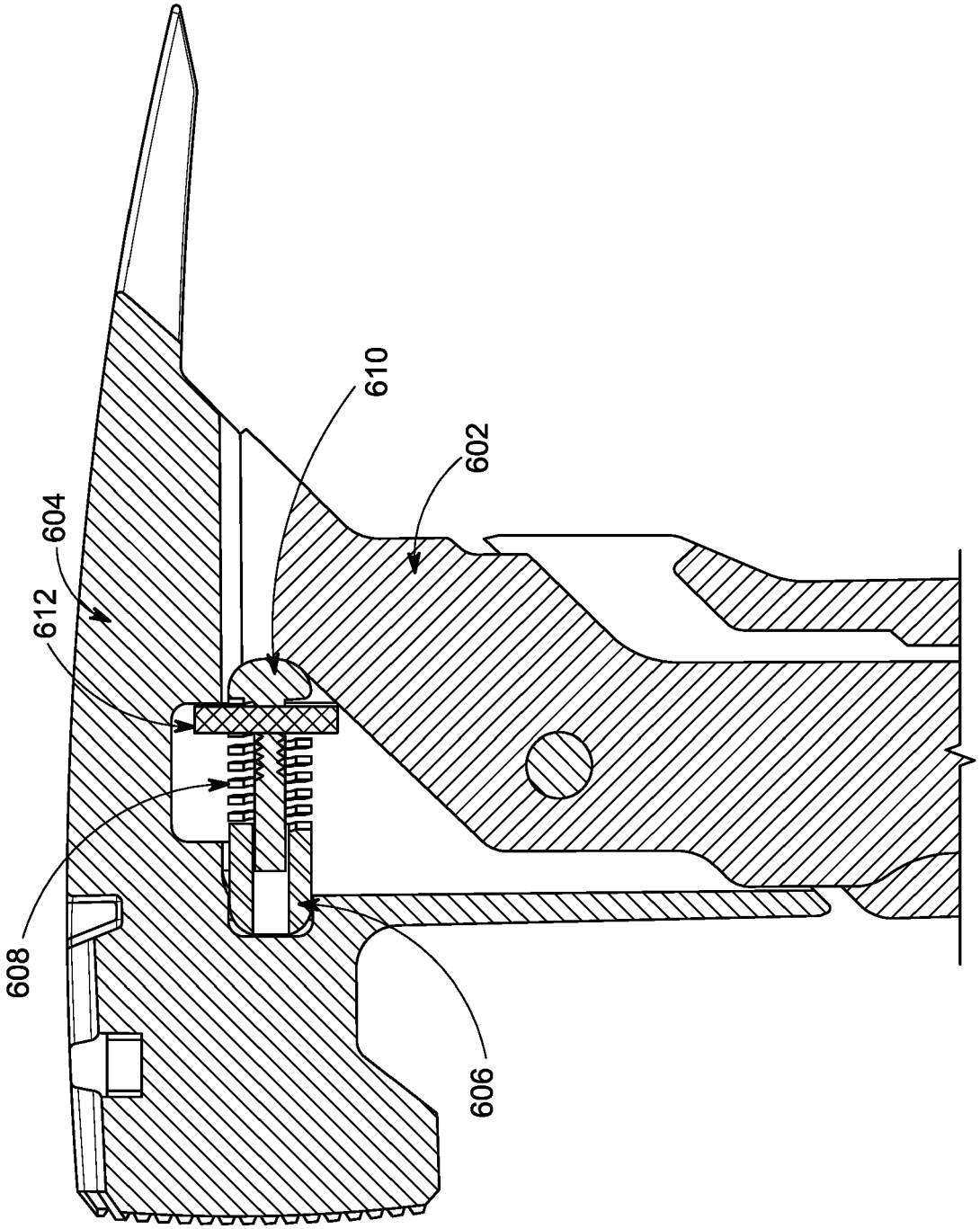

FIG. 6

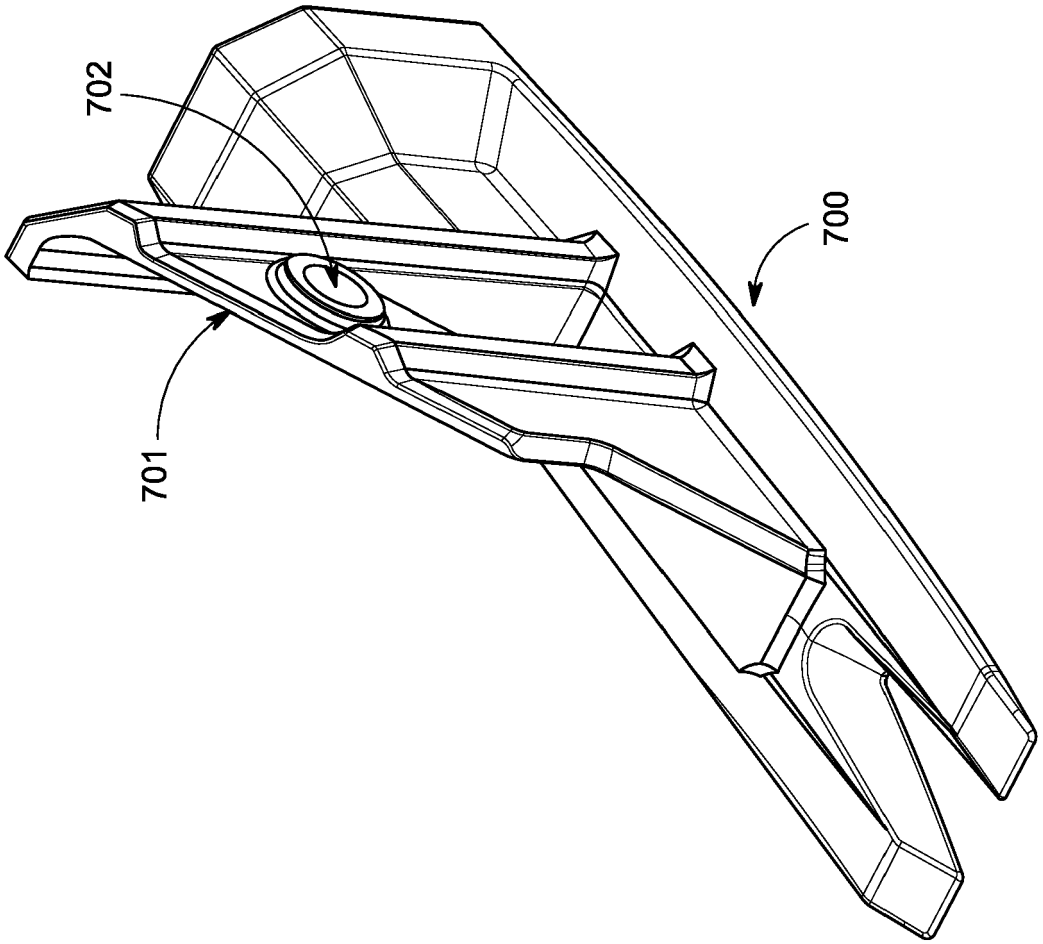

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 23 17 7133

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			TECHNICAL FIELDS SEARCHED (IPC) B25D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 November 2023	Lorence, Xavier

CATEGORY OF CITED DOCUMENTS

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REFERENCES CITED IN THE DESCRIPTION

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