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(54) **Vibration-damped striking tool**

(57) A vibration-damped striking tool includes a head (20) having a connected segment (23) pivotally connected to a connecting segment (36) of an elongated handle (20) such that a guided region (26) of the connected segment (23) is in frictional engagement with and angularly displaceable relative to a guiding region (362) of the con-

necting segment (36) so as to make an angular displacement when the head (20) strikes an object. A damping unit (50) is disposed between the connected and connecting segments (23, 36) to counteract the angular displacement to thereby reduce vibration transmitted from the head (20) to the handle (30).

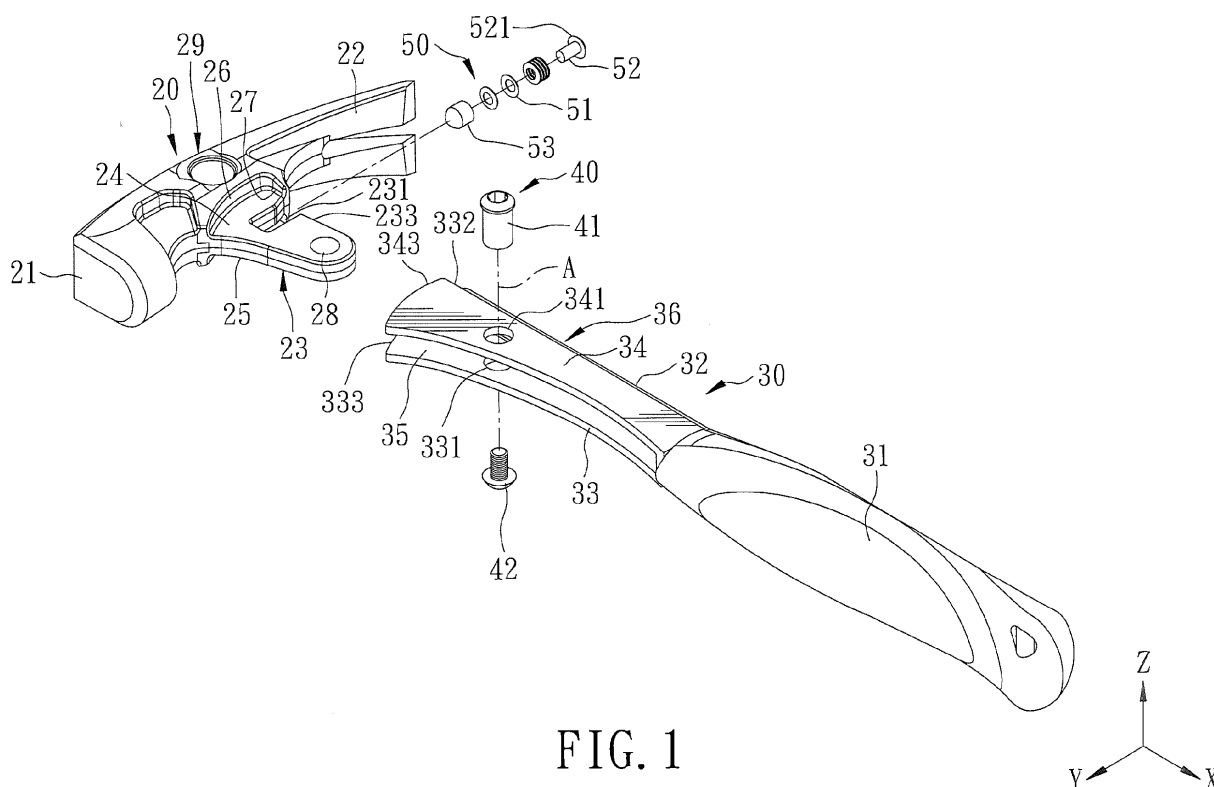


FIG. 1

Description

[0001] This invention relates to a hand-held striking tool, such as a hammer, more particularly to a vibration-damped striking tool having a vibration damping unit.

[0002] A conventional hand-held striking tool, such as a hammer, a racket, etc., generally includes a rigid head fixedly secured to a handle. When the tool is used to strike an object, vibration will be transmitted from the head through the handle to the hand or arm of the user wielding the striking tool. Repetitive hammering using such striking tool may result in injury to the user's hand or arm. A vibration damped hammer has been proposed, which has a handle having a resiliently deformable material molded on a grip thereof so as to reduce the level of vibration transmitted to the user's hand or arm. However, such handle is complicated to manufacture, and the resiliency/elasticity of the deformable material weakens after a period of use, thereby resulting in deterioration of the damping effect.

[0003] An object of the present invention is to provide a vibration-damped striking tool which is easy to manufacture and assemble and which can reduce vibration transmitted to a user efficiently even after a period of use.

[0004] According to this invention, the vibration-damped striking tool includes an elongated handle having a grip segment and a connecting segment opposite to each other in a longitudinal direction, and a head having a striking surface facing forwardly, a cheek extending from the striking surface in a transverse direction, and a connected segment extending from the cheek in the longitudinal direction. The connecting segment has first and second lug walls which are spaced apart from each other in an axial direction to define a receiving space therebetween, and each of which has a pivoting region that defines a pivot axis in the axial direction, and a guiding region that extends angularly about the pivot axis to terminate at a lateral edge area facing rearward. The connected segment is received in the receiving space, and has a pivoted region which is pivotably connected to the pivoting regions. The connected segment is thinner than the cheek to cooperatively form therebetween at least one guided region that confronts one of the guiding regions, and a barrier region that confronts one of the lateral edge areas. The guided region is configured to mate with and be in frictional engagement with a corresponding one of the guiding regions. When the head strikes an object, a reaction force exerted on the striking surface causes an angular displacement of the guided region from a non-striking position, where the barrier region abuts against a corresponding one of the lateral edge areas, to a striking position, where the barrier region is disengaged from the corresponding one of the lateral edge areas.

[0005] The striking tool further includes a damping unit which is disposed between the connected segment and the connecting segment to counteract the angular displacement of the guided region so as to reduce vibration transmitted from the head to the handle.

[0006] Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiment of the invention, with reference to the accompanying drawings, in which:

Fig. 1 is an exploded perspective view of an embodiment of a vibration-damped striking tool according to this invention;

Figs. 2 and 3 are left and right side views of a head of the embodiment, respectively;

Figs. 4, 5 and 6 are left, front, and rear side views of a handle of the embodiment, respectively;

Fig. 7 is a fragmentary exploded perspective view of the embodiment;

Fig. 8 is a perspective view of the embodiment;

Fig. 9 is a fragmentary side view of the embodiment in a non-striking state;

Fig. 10 is a fragmentary sectional view of the embodiment in the non-striking state;

Fig. 11 is a fragmentary side view of the embodiment in a striking state;

Fig. 12 is a fragmentary sectional view of the embodiment in the striking state;

Fig. 13 is an exploded perspective view of another embodiment of the vibration-damped striking tool according to this invention; and

Fig. 14 is a fragmentary sectional view of the embodiment shown in Fig. 13.

[0007] Referring to Fig. 1, an embodiment of a vibration-damped striking tool according to the present invention is shown to comprise an elongated handle 30, a head 20, a pin unit 40, and a damping unit 50.

[0008] Referring to Figs. 1, 4 to 6, the handle 30 has a grip segment 31 and a connecting segment 36 opposite to each other in a longitudinal direction (X). The connecting segment 36 has first and second lug walls 33, 34 which are spaced apart from each other in an axial direction (Z) transverse to the longitudinal direction (X), and a rear wall 32 which interconnects rear sides of the first and second lug walls 33, 34 to define a receiving space 35 therein. The first and second lug walls 33, 34 and the rear wall 32 extend in the longitudinal direction (X) to terminate at first and second marginal edges 333, 343 and an upper marginal edge 323. Each of the first and second marginal edges 333, 343 is configured to angularly extend about a pivot axis (A) that is oriented in the axial direction (Z) to serve as a guiding region 333, 343. The upper marginal edge 323 is lower than the first and second marginal edges 333, 343 to cooperatively and respectively define lateral edge areas 332, 342 that face rearward. Each of the first and second lug walls 33, 34 has a pivoting region 331, 341 in the form of a hole that defines the pivot axis (A),

[0009] Referring to Figs. 1 to 3 and 7, the head 20 has a striking surface 21 facing forwardly, a cheek 29 extending from the striking surface 21 in a transverse direction (Y) transverse to both the longitudinal direction (X) and

the axial direction (Z) to terminate at a claw 22, and a connected segment 23 extending from the cheek 29 in the longitudinal direction (X). The connected segment 23 has first and second major surfaces 24, 25 configured to be received in the receiving space 35, and is thinner than the cheek 29 to cooperatively form two guided regions 26 that confront the guiding regions 333, 343, respectively, and two barrier regions 27 that confront the lateral edge areas 332, 342 in the transverse direction (Y). The connected segment 23 has a pivoted region 28 in the form of a hole which is registered with the pivoting regions 331, 341 of the connecting segment 36 along the pivot axis (A). The connecting segment 23 further has a rear concavity 231 which extends forwardly and in the transverse direction (Y) to terminate at a front wall 232 that faces the rear wall 32.

[0010] Referring to Figs. 7 and 8, the pin unit 40 includes a screw nut 41 extending through the holes in the pivoting regions 331, 341 and the pivoted region 28 along the pivot axis (A), and a screw stem 42 threadedly engaged with the screw nut 41 so as to permit the pivoted region 28 to be pivotally mounted with and between the pivoting regions 331, 341. Thus, the guided regions 26 are configured to mate with and be in frictional engagement with the guiding regions 333, 343, and are angularly displaceable relative thereto about the pivot axis (A).

[0011] Referring to Figs. 1, 7 and 10, the damping unit 50 is disposed in the rear concavity 231 and abuts against the front and rear walls 232, 32. Specifically, the damping unit 50 includes a guide tubular member 53 which abuts against the front wall 232 and which defines a tubular guideway 531 that extends in the transverse direction (Y), a guide stem 52 which is disposed to be slidably engaged in the tubular guideway 531, and which has an enlarged head 521, and a plurality of resilient members 51 which are sleeved on the guide stem 52 to abut against the guide tubular member 53 and the enlarged head 521. The resilient members 51 may be, for example, in the form of disc springs, coil springs, or the like.

[0012] Referring to Figs. 9 and 10, when the striking tool of this embodiment is in a non-striking state, i.e., the guided regions 26 are in a non-striking position, the barrier regions 27 respectively are brought to abut against the lateral edge areas 332, 342 while the damping unit 50 is in a normal state, and a damping space 60 is formed between the rear side 233 of the connected segment 23 and the rear wall 32.

[0013] Referring to Figs. 11 and 12, when the head 20 strikes an object 70, a reaction force exerted on the striking surface 21 causes rearward movement of the head 20 indicated by the arrow 80 and an angular displacement of the guided regions 26 to a striking position, where the barrier regions 27 are respectively disengaged from the lateral edge areas 332, 342, while the resilient members 51 are compressed so as to counteract the angular displacement of the guided regions 26, thereby reducing vibration transmitted from the head 20 to the handle 30. The extent of displacement of the guided regions 26 is

restricted by virtue of a blocking action of the rear wall 32 against the rear side 233 of the connected segment 23.

[0014] With the arrangement of the angularly displaceable guided regions 26 and the damping unit 50, the vibration transmitted to the handle 30 can be reduced efficiently. Besides, by means of mechanical displacement between the head 20 and the handle 30, a service life of the striking tool can be prolonged.

[0015] Referring to Figs. 13 and 14, alternatively, the connected segments 23 may have two of the rear concavities 231 such that two of the damping units 50 are respectively received in the rear concavities 231 so as to maximize the damping effect thereof.

Claims

1. A vibration-damped striking tool comprising:

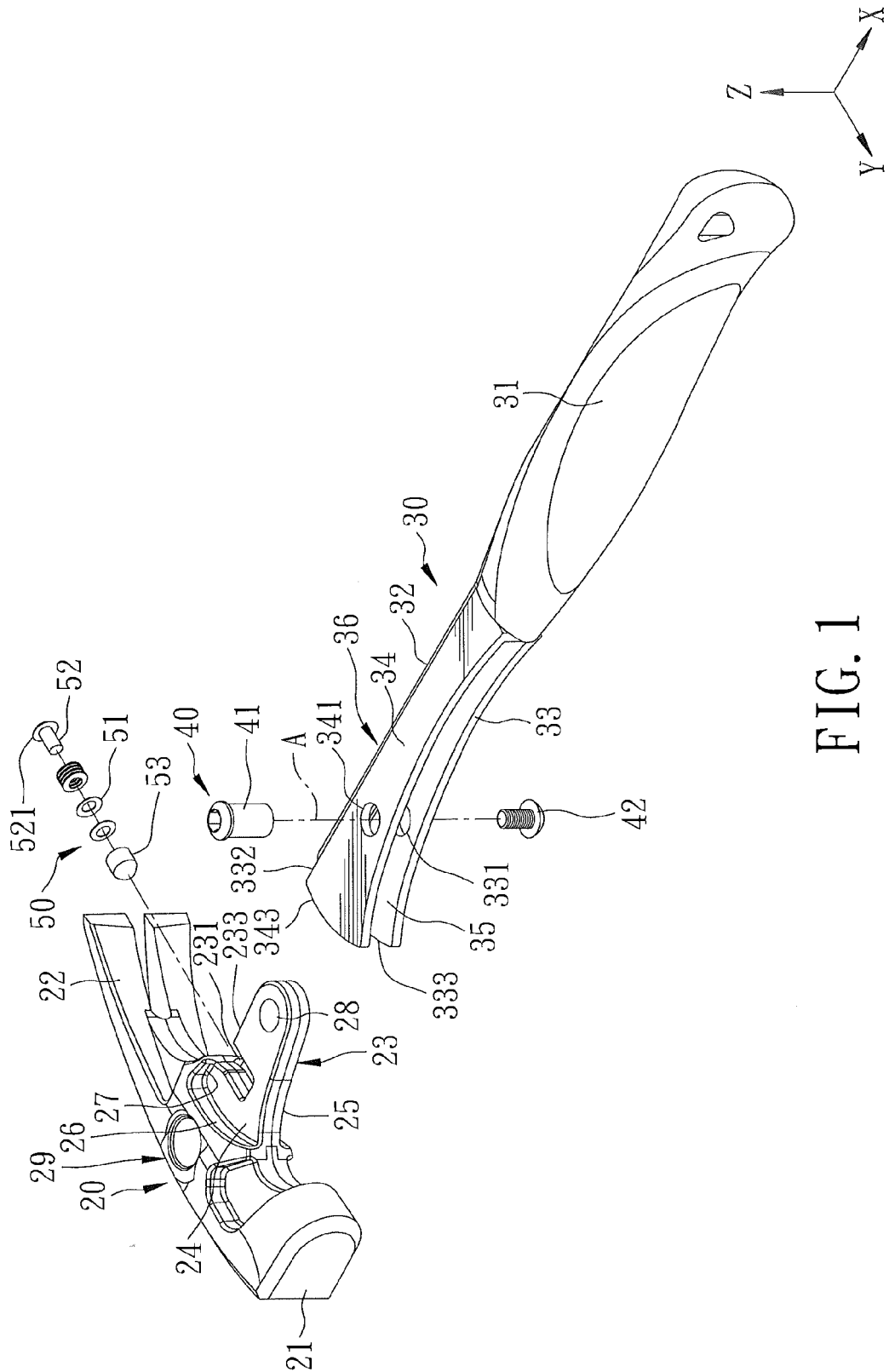
an elongated handle (30) having a grip segment (31) and a connecting segment (36) opposite to each other in a longitudinal direction (X); and a head (20) having a striking surface (21) facing forwardly, a cheek (29) extending from said striking surface (21) in a transverse direction (Y) transverse to the longitudinal direction (X), and a connected segment (23) extending from said cheek (29) in the longitudinal direction (X), **characterized in that:**

said connecting segment (36) has first and second lug walls (33, 34) which are spaced apart from each other in an axial direction (Z) transverse to both the longitudinal direction (X) and the transverse direction (Y) to define a receiving space (35) therebetween, and each of which has a pivoting region (331, 341) that defines a pivot axis (A) in the axial direction (Z), and a guiding region (333, 343) that extends angularly about the pivot axis (A) to terminate at a lateral edge area (332, 342) facing rearward; and said connected segment (23) being received in said receiving space (35), and having a pivoted region (28) which is pivotably connected to said pivoting regions (331, 341) about the pivot axis (A), said connected segment (23) being thinner than said cheek (29) to cooperatively form therebetween at least one guided region (26) that confronts one of said guiding regions (333, 343), and a barrier region (27) that confronts one of said lateral edge areas (332, 342) in the transverse direction (Y), said guided region (26) being configured to mate with and be in frictional engagement with a corresponding one of said guiding regions (333,

343) such that, when said head (20) strikes an object (70), a reaction force exerted on said striking surface (21) causes an angular displacement of said guided region (26) from a non-striking position, where said barrier region (27) abuts against a corresponding one of said lateral edge areas (332, 342), to a striking position, where said barrier region (27) is disengaged from the corresponding one of said lateral edge areas (332, 342); and **characterized by**:

a damping unit (50) which is disposed between said connected segment (23) and said connecting segment (36) to counteract the angular displacement of said guided region (26) so as to reduce vibration transmitted from said head (20) to said handle (30).

2. The vibration-damped striking tool as claimed in Claim 1, **characterized in that** said first and second lug walls (33, 34) extend in the longitudinal direction (X) to terminate at first and second marginal edges (333, 343) that are configured to angularly extend about the pivot axis (A) to serve as said guiding regions (333, 343), respectively, said connecting segment (36) further having a rear wall (32) interconnecting said first and second lug walls (33, 34) and extending in the longitudinal direction (X) to terminate at an upper marginal edge (323) which is lower than said first and second marginal edges (333, 343) so as to cooperatively define said lateral edge areas (332, 342), respectively.
3. The vibration-damped striking tool as claimed in Claim 2, **characterized by** a pin unit (40) which interconnects said pivoting regions (331, 341) and said pivoted region (28) to permit the angular displacement of said guided region (26).
4. The vibration-damped striking tool as claimed in Claim 3, **characterized in that** said pin unit (40) includes a screw nut (41) extending through said pivoting regions (331, 341) and said pivoted region (28) along the pivot axis (A), and a screw stem (42) threadedly engaged with said screw nut (41) so as to permit said pivoted region (28) to be pivotally mounted with and between said pivoting regions (331, 341).
5. The vibration-damped striking tool as claimed in Claim 2, **characterized in that** said connecting segment (23) has a rear concavity (231) which extends forwardly and in the transverse direction (Y) to terminate at a front wall (232) that faces said rear wall (32), said damping unit (50) being disposed in said rear concavity (231) and abutting against said front and rear walls (232, 32).
6. The vibration-damped striking tool as claimed in Claim 5, **characterized in that** said damping unit (50) includes a plurality of resilient members (51) configured to be compressed when said guided region (26) is displaced to the striking position so as to counteract the angular displacement of said guided region (26).
7. The vibration-damped striking tool as claimed in Claim 6, **characterized in that** said damping unit (50) further includes a guide tubular member (53) which abuts against said front wall (232) and which defines a tubular guideway (531) that extends in the transverse direction (Y), and a guide stem (52) which is disposed to be slidably engaged in said tubular guideway (531), said resilient members (51) being sleeved on said guide stem (52) to be compressed by said guide tubular member (53) while counteracting the angular displacement of said guided region (26).



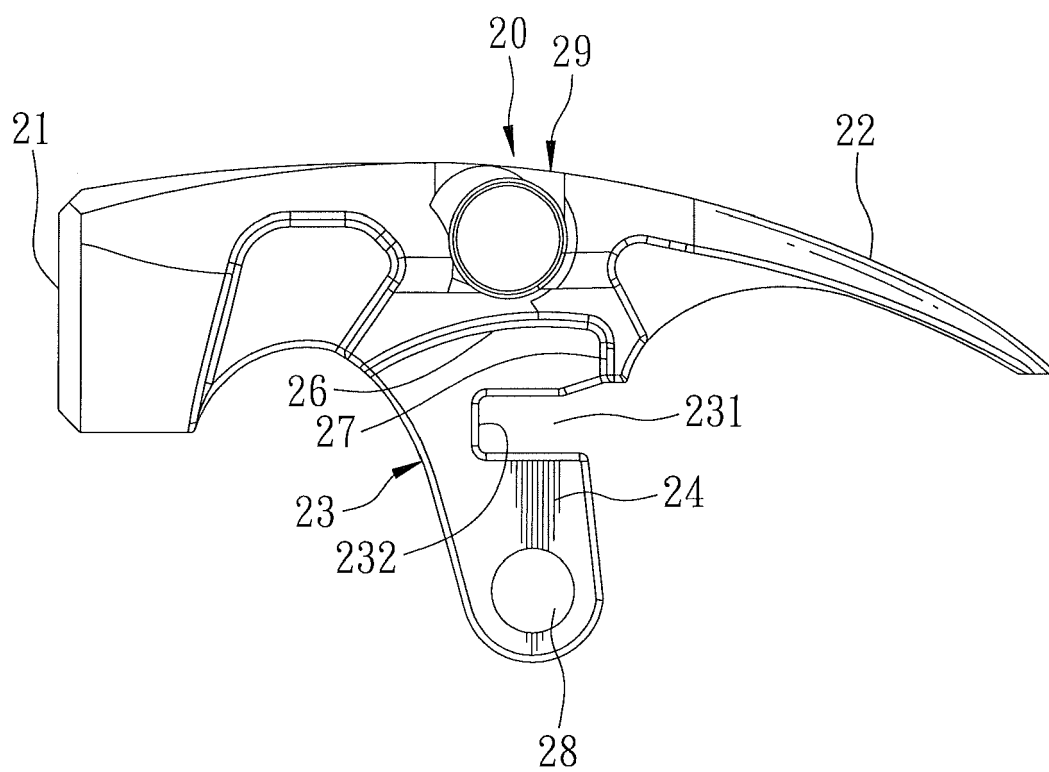


FIG. 2

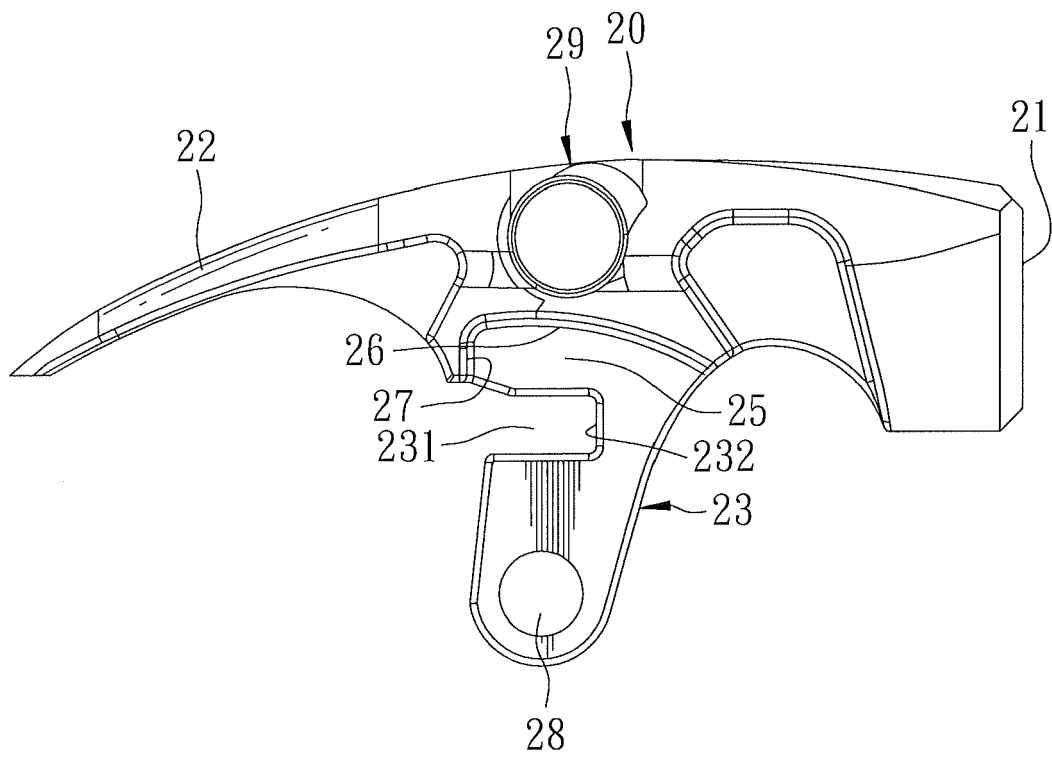


FIG. 3

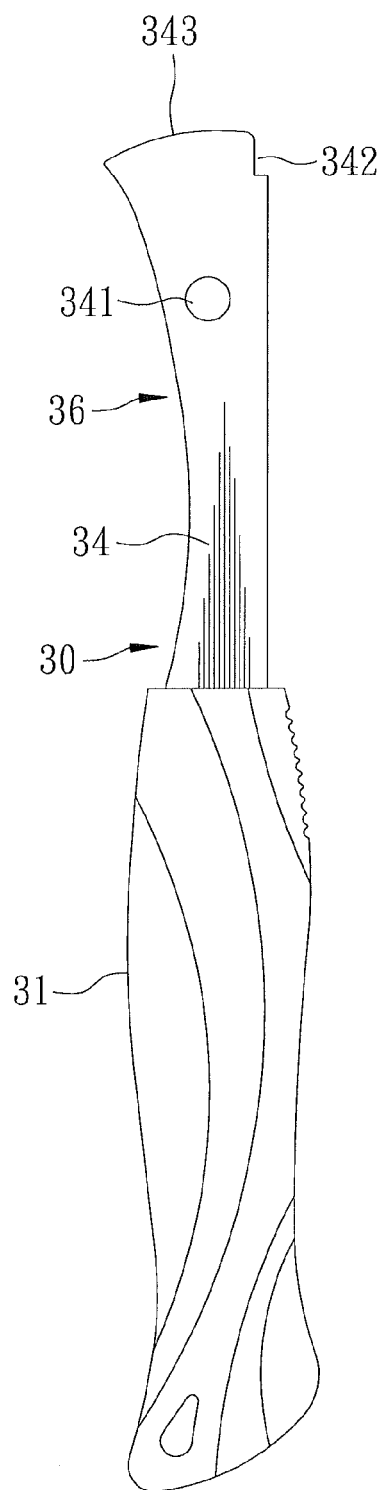


FIG. 4

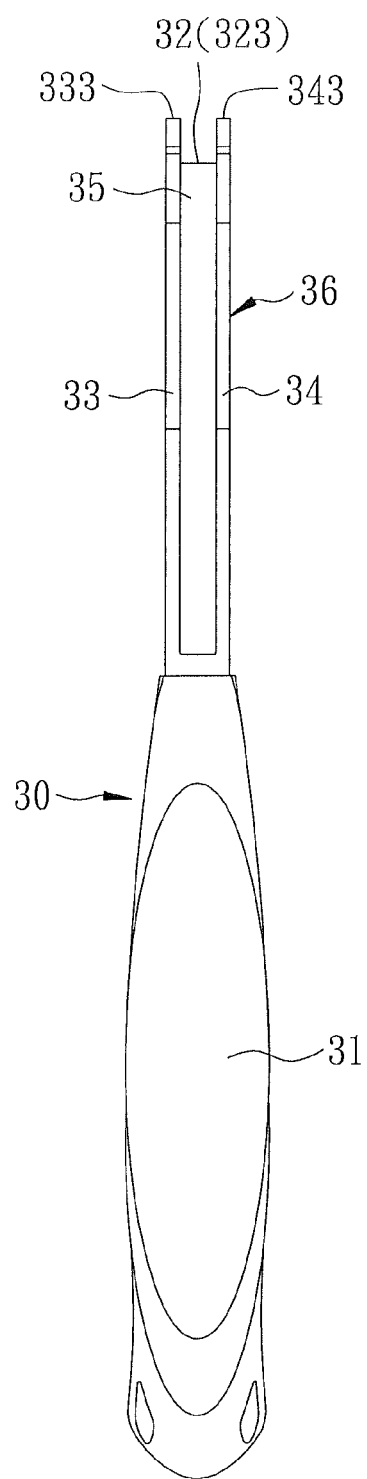


FIG. 5

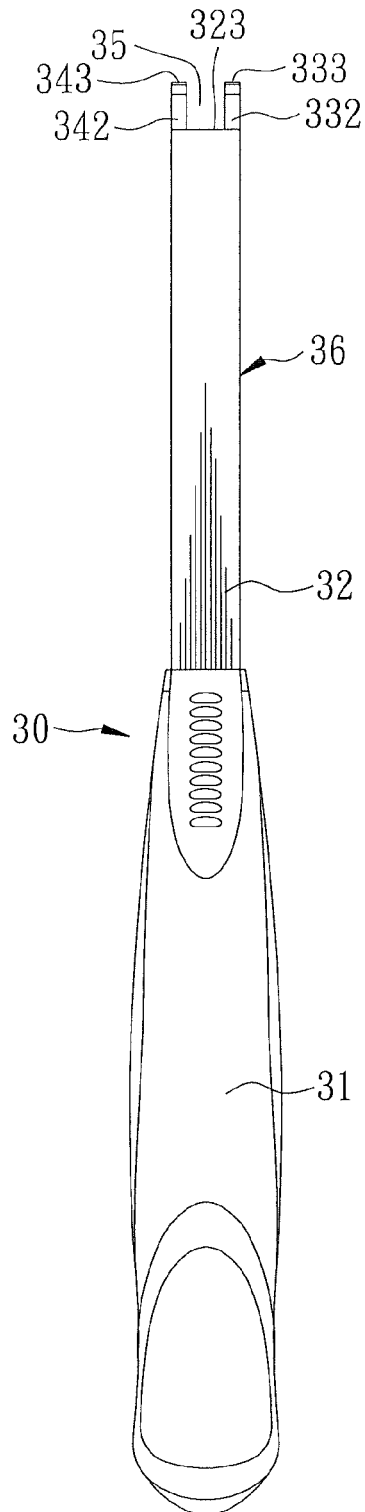


FIG. 6

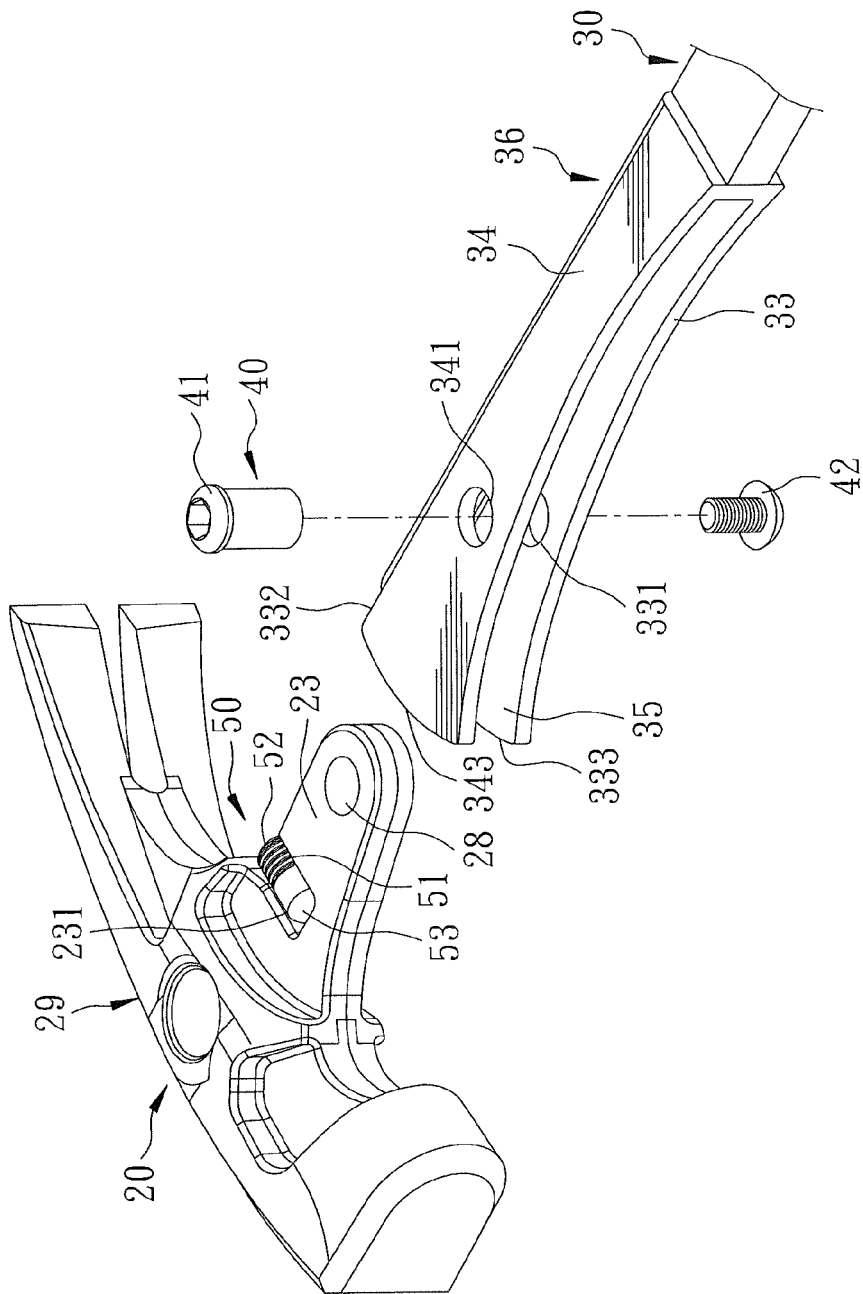


FIG. 7

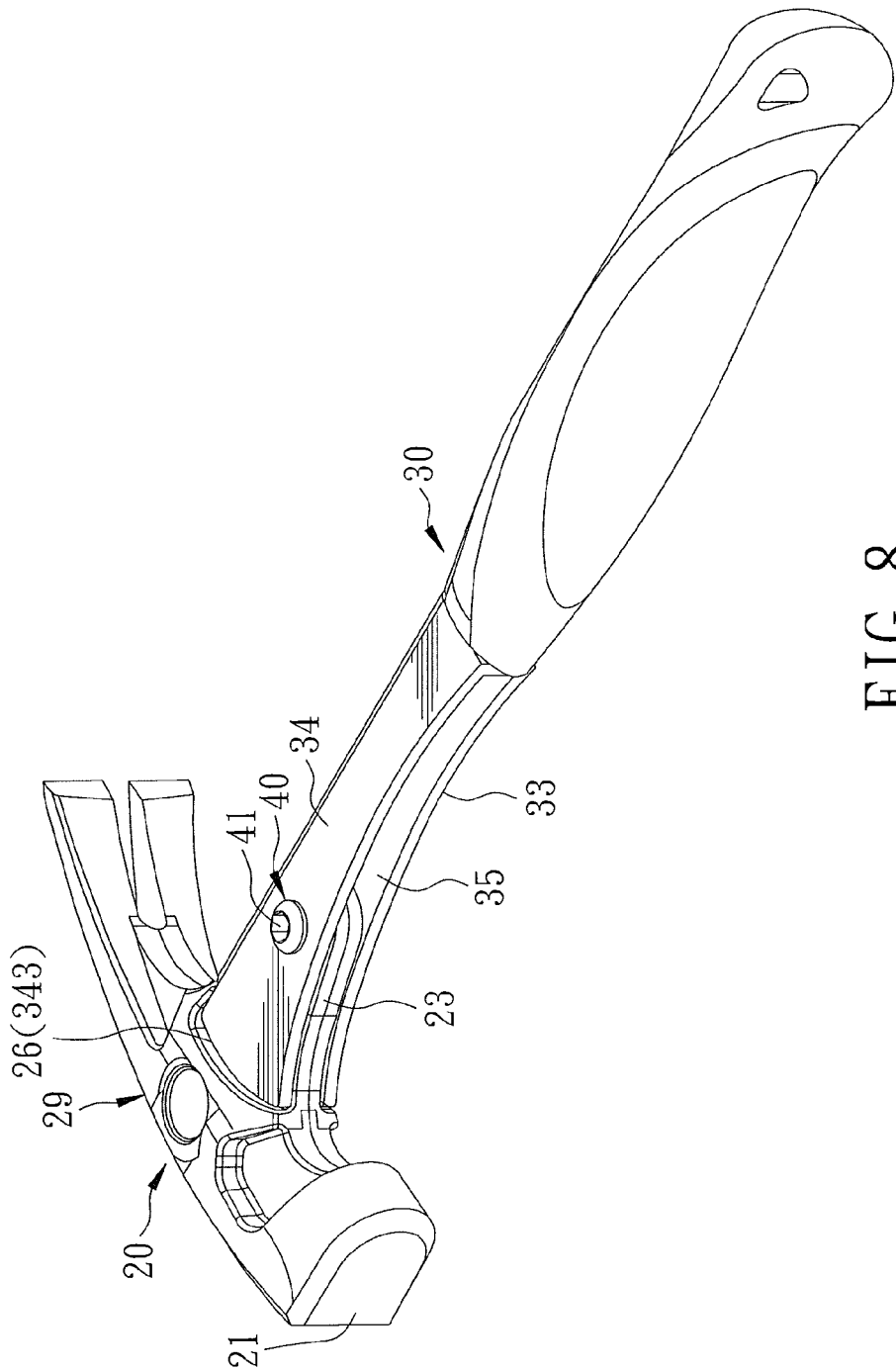


FIG. 8

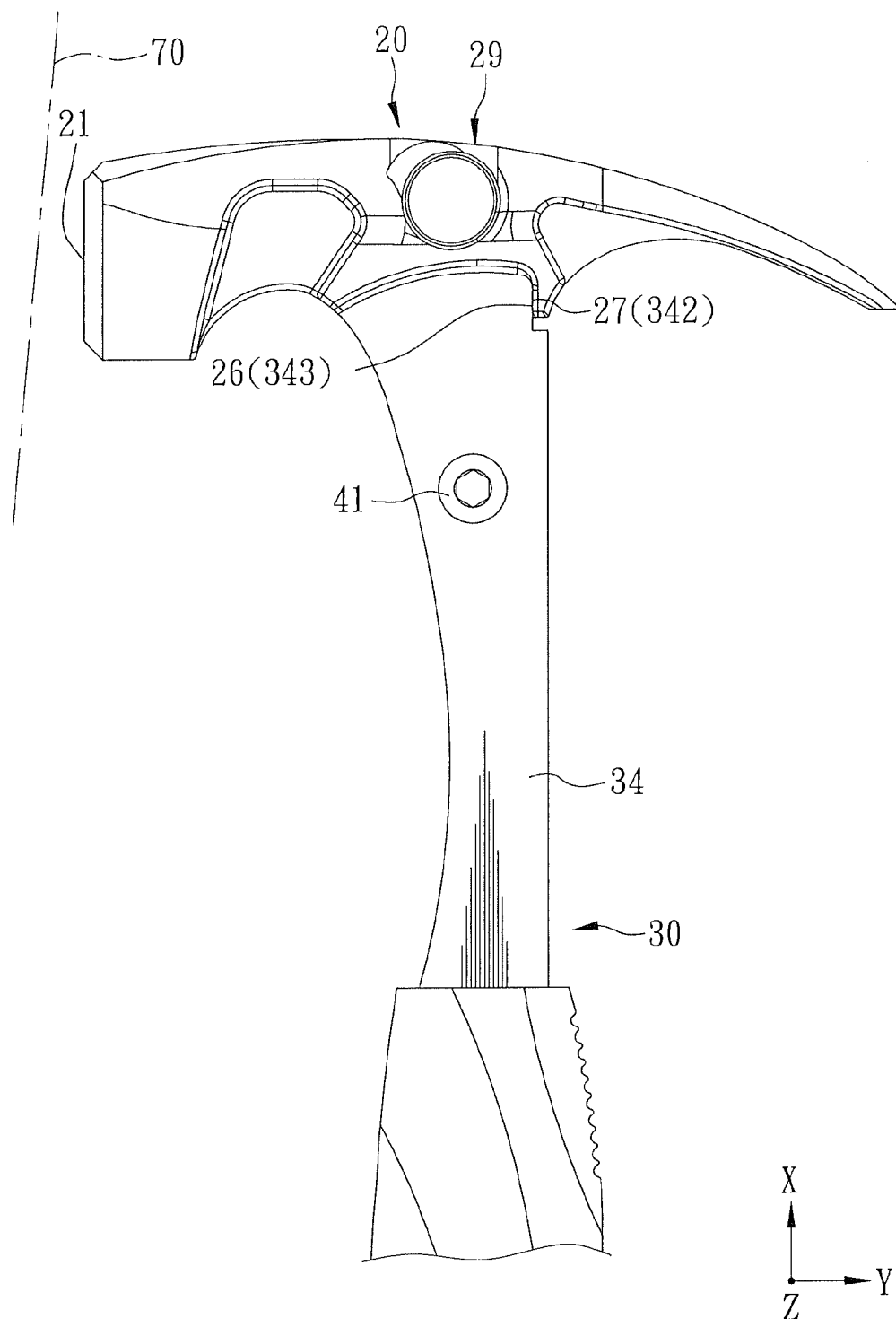


FIG. 9

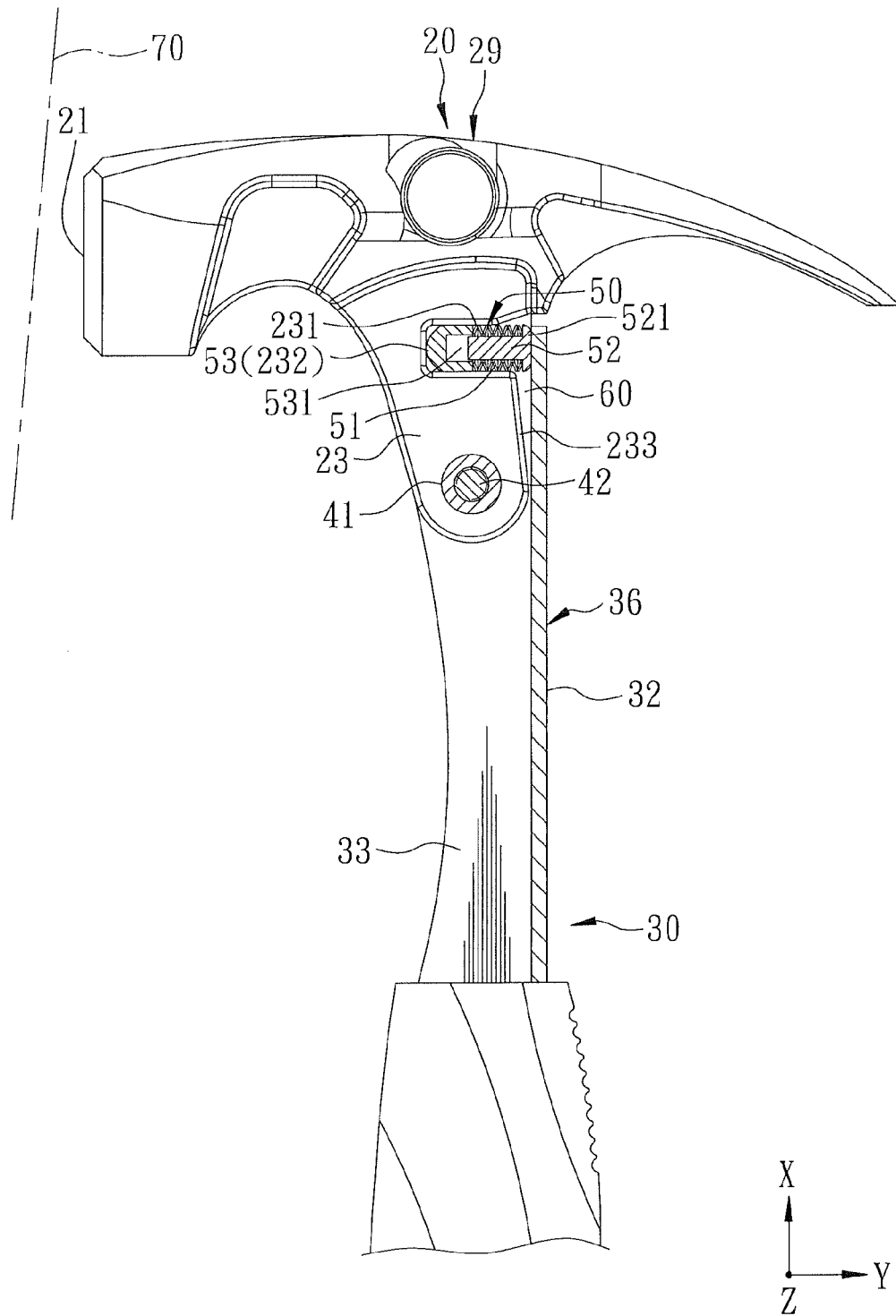


FIG. 10

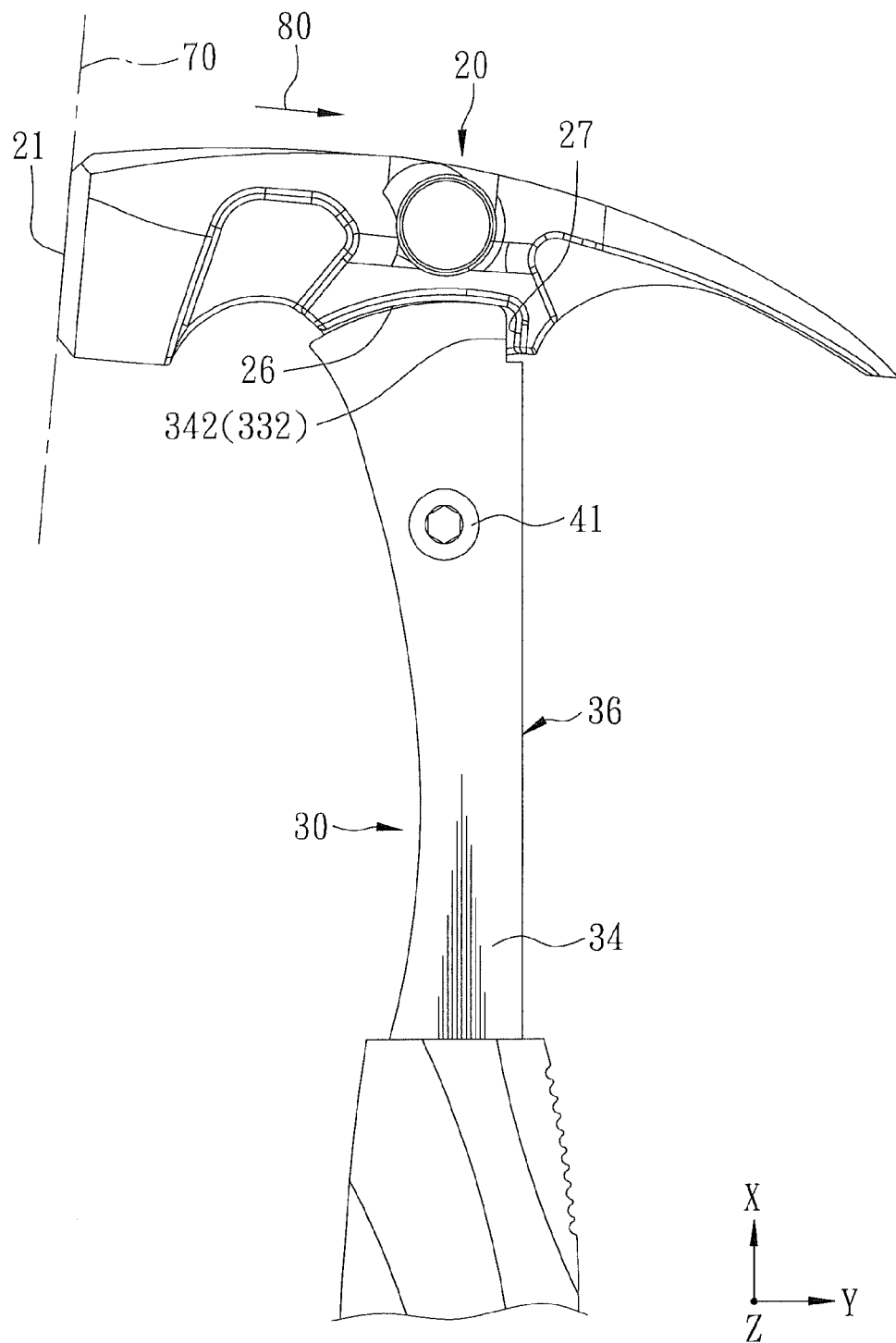


FIG. 11

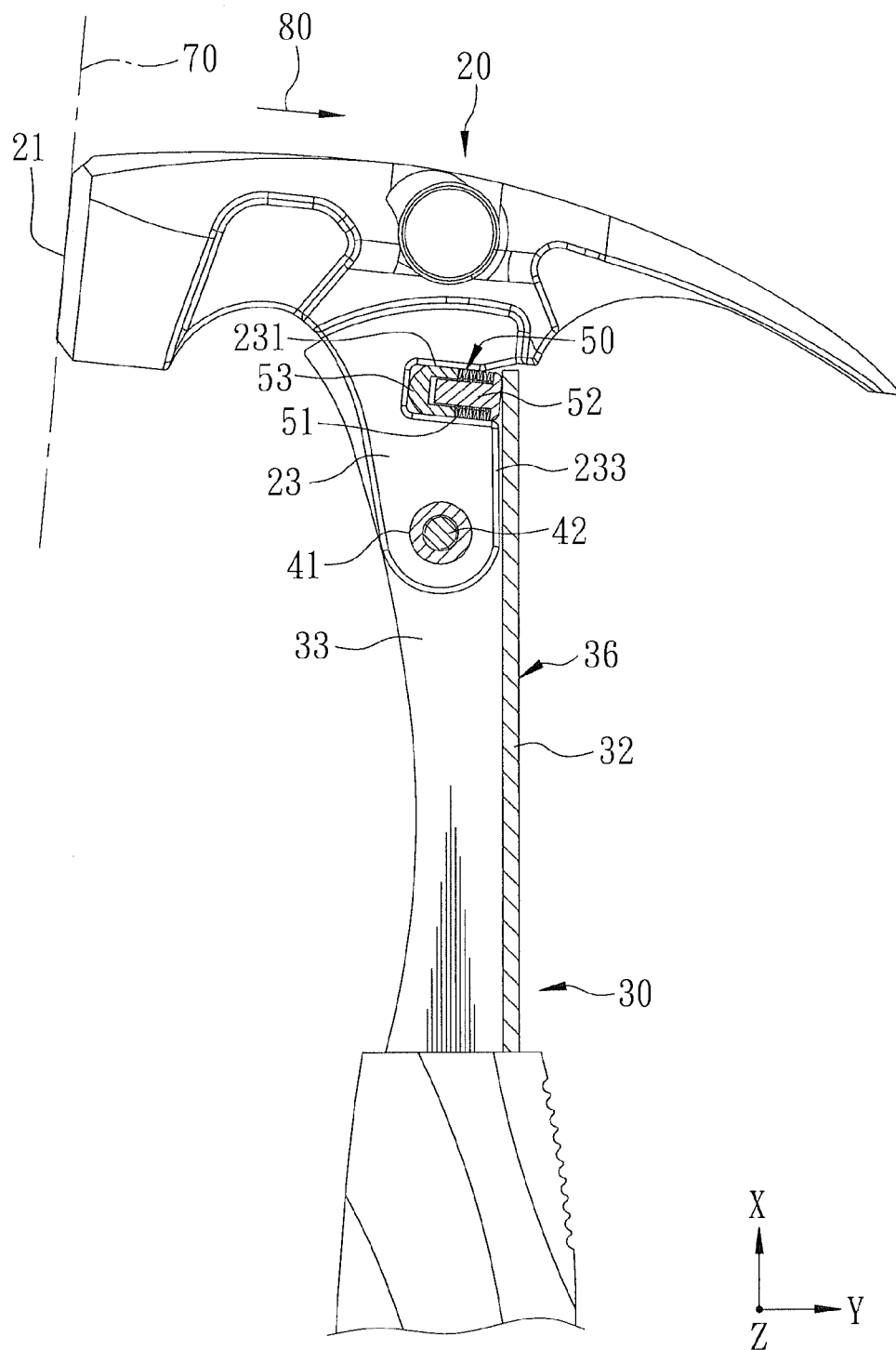


FIG. 12

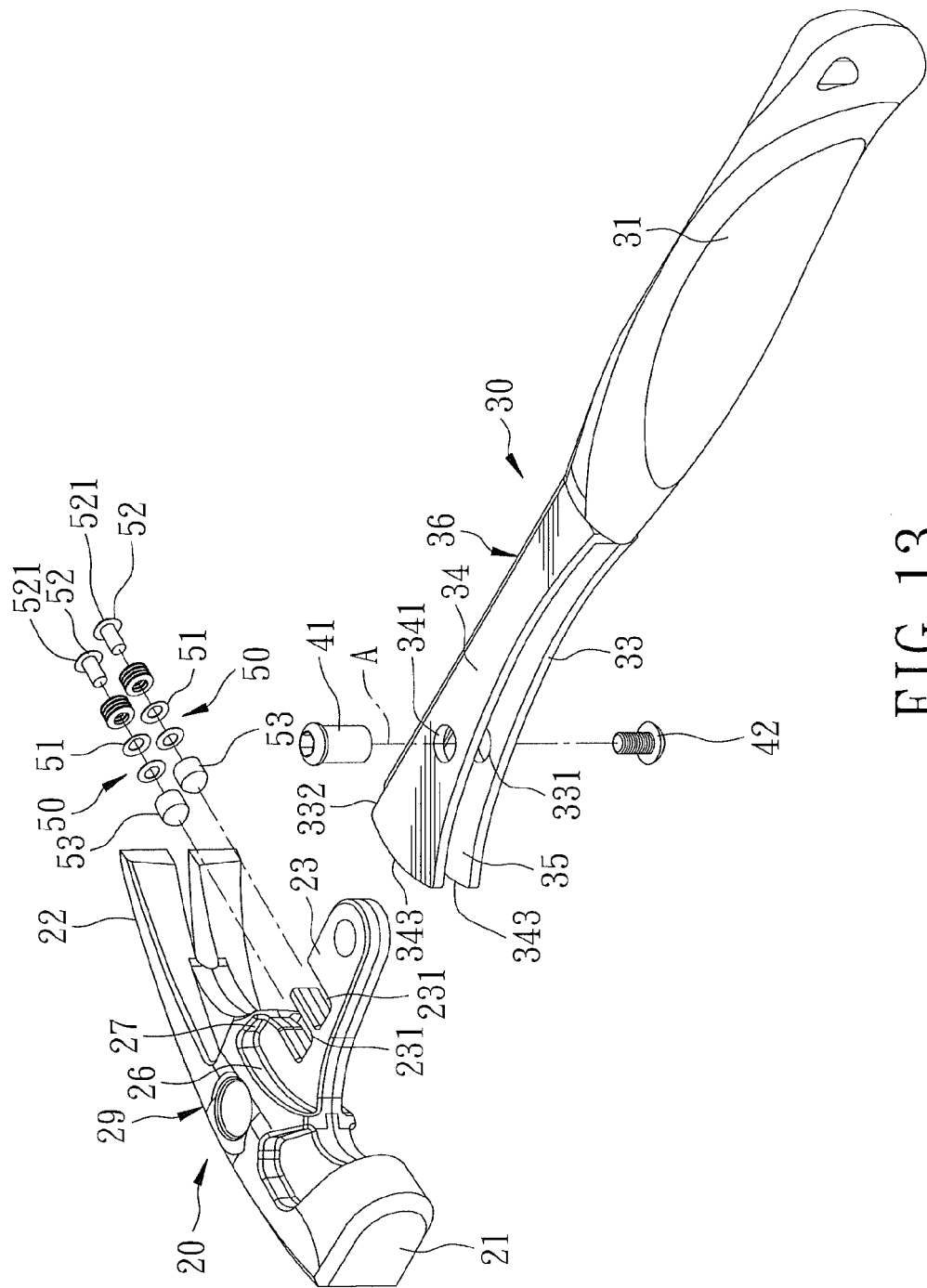


FIG. 13

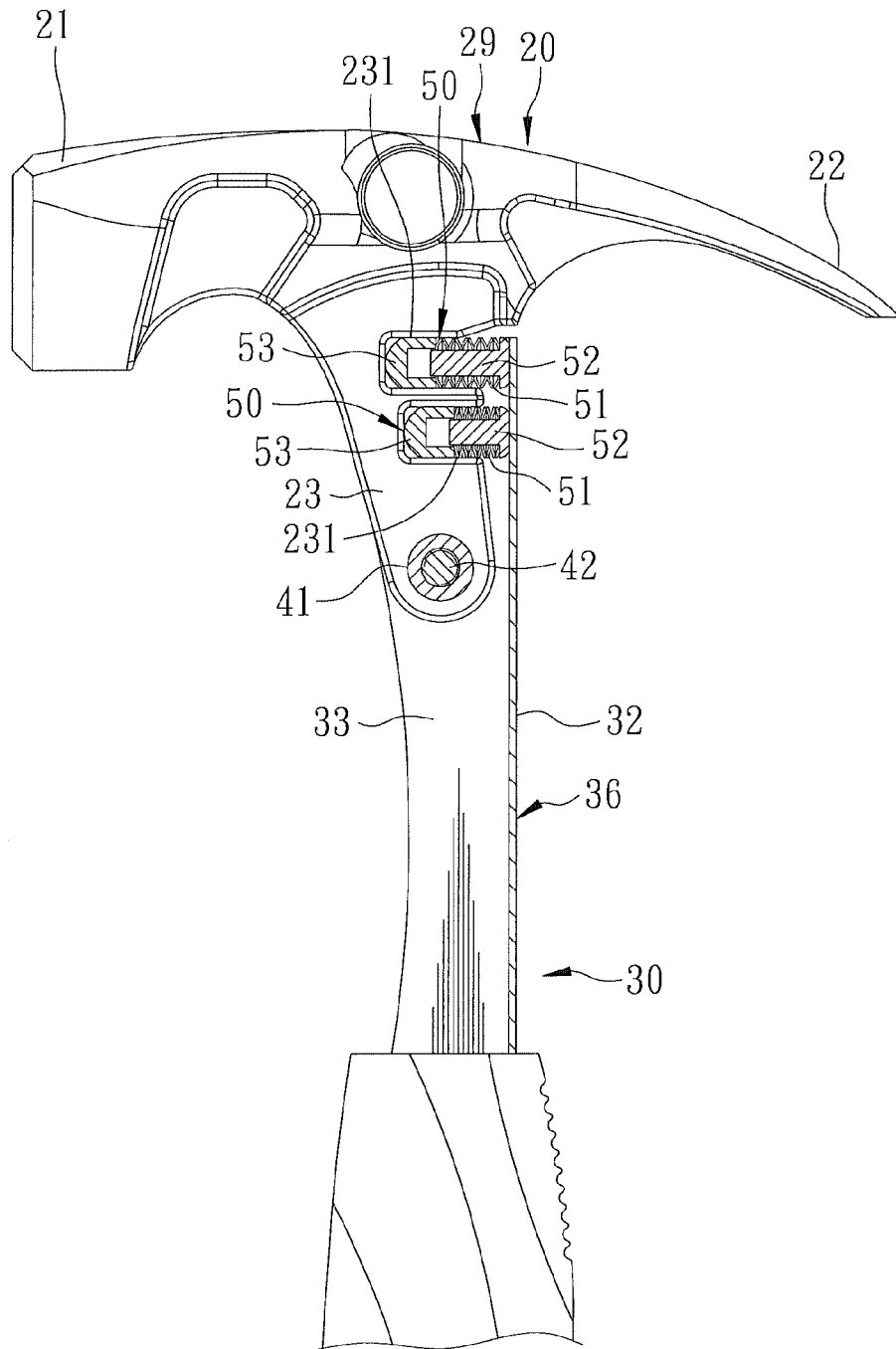


FIG. 14