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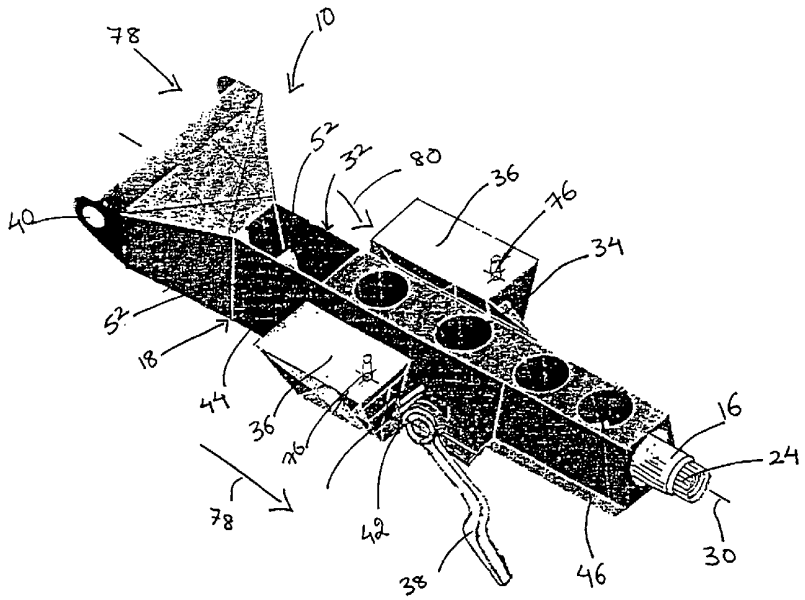

(57) Abstract: The present invention is generally directed a steering column housing. The steering column housing comprising a steering shaft, a column housing and a steering wheel. The column housing is designed to collapse in an axial direction away from the vehicular operator in the event of a vehicular impact. The column housing is provided with a collapsible region that collapses axially and also absorbs energy as it collapses. Additionally, the support brackets attached to the column housing is fastened to a guide retainer clip. The guide retainer clip attaches the column housing to motor vehicle during normal operations and guides the movement of the column housing away from the vehicular operator during a vehicular impact.

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PLASTIC METAL HYBRID STEERING COLUMN FOR AUTOMOTIVE APPLICATIONS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Provisional Patent Application Serial No. 60/259,164 filed January 2, 2001 entitled TILT-ADJUSTABLE PMH (PLASTIC METAL HYBRID) STEERING COLUMN.

TECHNICAL FIELD OF THE INVENTION

[0002] This invention relates to vehicle steering columns in a motor vehicle. More particularly, to a collapsing region and a guide retainer clip for a collapsible steering column in a motor vehicle.

BACKGROUND OF THE INVENTION

[0003] In a frontal impact caused, for example, by a head-on collision, the driver is often thrown forward against the steering wheel with great force. The result can be serious injury or death. Due to the forces generated on the steering column by the individual contacting the steering wheel during collision, the steering column tends to move in an upward direction along with moving forward.

[0004] In order to reduce the force exerted on the driver of the motor vehicle it has been known to provide various collapsible and energy absorbing steering columns in automotive vehicles to reduce injury to a driver during a collision type impact of the motor vehicle

[0005] However, there has been a need in the industry to provide a guide structure for the steering column that inhibits upward movement of the steering column during collision, which directs movement of the steering column in an axial direction during collision and which absorbs energy during a collision of the motor vehicle.

SUMMARY OF THE INVENTION

[0006] In accordance with the teachings of the present invention a steering column assembly for a motor vehicle adapted to collapse away from a vehicular operator during a collision of the motor vehicle is provided.

[0007] The steering column assembly comprises a steering wheel, a steering shaft, and a column housing. One end of the steering shaft is connected to a steering wheel. The column housing defines a collapsible region such that during the collision of the motor vehicle the collapsible region gets deformed in an axial direction away from the operator.

[0008] In another aspect of the present invention, the column housing also defines a bracket attachable to the column housing. A guide retainer clip is fastenable to the bracket such that column housing is attached to the motor vehicle through the guide retainer clip.

[0009] In yet another aspect of the invention, the guide retainer clip guides the movement of the column housing in an axial direction away from the vehicular operator during the collision of the motor vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Further features of the invention will become apparent from the following discussion and the accompanying drawings in which:

[0011] FIGURE 1 is a perspective view of the motor vehicle incorporating the features of the present invention;

[0012] FIGURE 2 is a rear view of the steering column assembly in accordance with the teachings of the present invention;

[0013] FIGURE 3 is a front view of the of the steering column assembly in accordance with the teachings of the present invention;

[0014] FIGURE 4 is an exploded view of the support bracket and the guide retainer clip as attachable to the motor vehicle in accordance with the teachings of the present invention; and

[0015] FIGURE 5 is a front view of the support bracket and the guide retainer clip as attached to the motor vehicle in accordance with the teachings of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0016] The following description of the preferred embodiment is merely exemplary in nature and is in no way intended to limit the invention or its application or uses.

[0017] Referring in particular to the FIGURES 1 and 2, a steering column assembly incorporating the features of the present invention is generally shown and designated by reference numeral 10.

[0018] The steering column assembly 10 is installed in the interior 12 of a motor vehicle 14. The steering column assembly 10 comprises a steering shaft 16, a column housing 18 and a steering wheel 20. The steering wheel 20 is operatable by a vehicular operator 21. The front end 22 of the steering shaft 16 i.e the end facing the vehicular operator 21 is connected to the steering wheel 20 and the rear end 24 of the steering shaft 16 is connected to a universal joint 26, leading to steering mechanisms, adapted to be connected to the wheels 28 of the motor vehicle 14. The steering shaft 16 defines an axis 30 (as shown in FIGURE 2). The steering shaft 16 is preferably formed of metal and is made of one or more pieces. Preferably, the steering shaft 16 is designed such that it is capable of collapsing telescopically under the impact of the vehicular operator's 21 torso in the event of a collision.

[0019] Referring in particular to FIGURES 2 and 3, the column housing 18 comprises a collapsible region 32 (shown in FIGURE 3), a support bracket 34, a guide retainer clip 36 attached to the support bracket 34, a position adjustment lever 38, a tilt hinge 40 and a tilt adjustment locking device 42. The column housing 18 also defines an axis that coincides with the axis 30 of the steering shaft 16. The column housing 18 is preferably formed of a metal sheet frame 44 reinforced with a plastic material 46 such as DURETHAN® commercially produced by Bayer Corporation. Typically the plastic material 46 is over molded to the metal sheet frame 44.

[0020] The tilt adjustment locking device 42 can work by means of a teeth engagement between retainer plates and locking plate. The vehicular operator 21 of the motor vehicle 14 can adjust the angular position of the steering column assembly 10 by pushing down on the position adjustment lever 38 and engaging the teeth of the retainer plate.

[0021] Referring in particular to FIGURE 3, the collapsible region 32 is preferably located at the front of the column housing 18. Alternatively, the collapsible region 32 may be located at the rear or central of the column housing 18.

As shown, the collapsible region 32 is formed by inserting flat plastic ribs 54 between the walls 52 of the column housing 18. The flat plastic ribs 54 are preferably placed parallel to each other such that during collision of the motor vehicle 14 the column housing 18 collapses in an axial direction away from the vehicular operator 21, thereby reducing the load on the vehicular operator 21 of the motor vehicle 14. The collapsible region 32 also acts as an energy absorbing system during the collapse of the column housing 18 during the vehicular impact. Alternatively, the collapsing region 32 may be formed by alternating the thickness of the walls 52 of the column housing 18, thereby creating strong and weak areas in the collapsible region 32. In order to further strengthen the column housing 18, x-shaped or honeycomb shaped plastic reinforcements 56 are provided between the walls 52 of the column housing 18.

[0022] Referring in particular to FIGURES 2, 4 and 5, in order to attach the column housing 18 to the interior 12 of the motor vehicle 14 the column housing 18 is provided with a support bracket 58. The support bracket 58 is a L-shaped bracket defining a first face 60 and a second face 62 substantially perpendicular to the first face 60. The first face 60 is attached to the walls 52 of the column housing 18 (as shown in FIG. 2) using traditional attaching methods such as welding or fasteners. Alternatively, it is possible that the column housing 18 is formed as an integral piece with the support bracket 58 attached to the walls 52 of the column housing 18. The second face 62 of the support bracket 58 extends away from the column housing 18.

[0023] In order to attach the column housing 18 to the motor vehicle 14 the second face 62 of the support bracket 58 is provided with a slot 64 and a plurality of holes 66. The slot 64 is preferably, U-shaped. Alternatively, the slot 64 may have other shapes. The support bracket 58 is attachable to a guide retainer clip 70. The guide retainer clip 70 assists in attaching the column housing 18 to the motor vehicle 14 and guide the axial collapse of the column housing 18 during collision. Preferably the guide retainer clip 70 is attachable to the second face 62 of the support bracket 58.

[0024] The guide retainer clip 70 is a long U-shaped plastic sleeve over molded to the second face 62 of the support bracket 58. The guide retainer clip 70 defines an aperture 72 and a plurality of holes 74 that coincide with the plurality of

holes 66 on the second face 62 of the support bracket 58. The aperture 72 is capable of receiving an attachment bolt 76 from the motor vehicle 14. In order to attach the guide retainer clip 70 to the support bracket 58, the plurality of holes 66 on the second face 62 of the support bracket 58 are aligned with the plurality of holes 74 on the guide retainer clip 70 and plastic fastener 68 are inserted through the plurality of holes 66 and 74. As will be explained later, the plastic fasteners 68 are designed to sheer under a predetermined collapse load. Additionally, the aperture 72 on the guide retainer clip 70 is aligned with the slot 64 on the support bracket 58 such that attachment bolt 76 from the motor vehicle 14 passes through the slot 64 to the aperture 72 on the guide retainer clip 70. Therefore, the support bracket 58 is attached to the motor vehicle 14 through the guide retainer clip 70 by the attachment bolt 76 (as shown in FIGURE 5).

[0025] Referring in particular to FIGURES 1, 2, and 5, during the collision of a motor vehicle, the vehicular operator 21 of the motor vehicle will move towards the steering wheel 20 as shown by arrows 78 in FIGURE 1 and exert load on the steering wheel 20. This impact on the steering wheel 20 will cause a downward axial load, as shown by arrows 80 on FIGURES 2 and 5 on the column housing 18 and the steering shaft 16. As discussed above, the steering shaft 16 is designed such that is collapses telescopically independent of the collapse of the column housing 18. Under the compressive load, the walls 52 in the collapsible area 32 of the column housing 18 will deform and will help absorb energy as the column housing 18 is collapsing, thereby reducing the load on the vehicular operator 21 of the motor vehicle.

[0026] After the collapse of the collapsible region 32, the plastic fasteners 68 that attach the support bracket 58 to the guide retainer clip 70 are designed to sheer at a pre-determined load. The sheering of the fasteners 68 will cause the attachment bolt 76 to slide out of the slot 64 and allow the column housing 18 break away from the attachment point to the motor vehicle as shown by arrows 82 in FIGURE 5. The guide retainer clip 70 will guide the axially downward collapse of the column housing 18 in a direction away from the vehicular operator 21. During collapse of the column housing 18, the attachment bolts 76 are designed to remain affixed to the guide retainer clip 70 and the motor vehicle 14. Therefore, during a

collision, the support bracket 58 will travel with the column housing 18 while the guide retainer clip 70 and the attachment bolt 76 remain attached to the motor vehicle. As seen above, the guide retainer clip 70 attaches the column housing 18 to the motor vehicle during normal operations and guides the collapse of the column housing 18 in a downward axial movement during the crash of the steeling column assembly 10 thereby substantially preventing the upward movement of the steering column assembly 10 towards the vehicular operator 21.

[0027] As any person skilled in the art will recognize from the previous description and from the figures and claims, modifications and changes can be made to the preferred embodiment of the invention without departing from the scope of the invention as defined in the following claims.

CLAIMS

What is claimed is:

1. A steering column assembly for a motor vehicle adapted to collapse away from a vehicular operator during a vehicle impact, the assembly comprising:

a steering wheel operable by the vehicular operator;

a steering shaft, wherein one end of the steering shaft is attachable to the steering wheel;

a column housing for housing the steering shaft;

a collapsible region defined in the column housing, wherein the collapsible region is capable of collapsing in an axial direction away from the vehicular operator under a predetermined load;

a support bracket attachable to the column housing; and

a guide retainer clip fastenable to the support bracket for attaching the column housing to the motor vehicle, wherein the guide retainer clip guides the movement of the column housing in an axial direction away from the vehicular operator during the vehicle impact under the predetermined load, such that the guide retainer clip remains attached to the motor vehicle during the vehicle impact.

2. The assembly of claim 1, wherein the steering shaft is capable of collapsing telescopically away from the vehicular operator independent of the column housing.

3. The assembly of claim 1, wherein the column housing is made of a metal sheet reinforced with a plastic material.

4. The assembly of claim 1, wherein the column housing is reinforced using x-shaped plastic ribs between walls of the column housing.

5. The assembly of claim 1, wherein the collapsible region is formed by placing flat plastic ribs between walls of the column housing.

6. The assembly of claim 5, wherein the flat plastic ribs are placed parallel to each other such that the walls absorb energy as the column housing collapses under the predetermined load.

7. The assembly of claim 1, wherein the support bracket is a L-shaped bracket having a first face and a second face substantially perpendicular to the first face.

8. The assembly of claim 7, wherein the first face is attachable to the column housing.

9. The assembly of claim 7, wherein the second face is attachable to the motor vehicle.

10. The assembly of claim 1, wherein the support bracket defines a slot to slidably receive an attachment bolt from the motor vehicle.

11. The assembly of claim 10, wherein the guide retainer clip defines an aperture corresponding to the slot on the support bracket, such that the aperture is adapted to receive the attachment bolt to attach the support bracket to the motor vehicle.

12. The assembly of claim 1, wherein the support bracket defines a plurality of holes to receive fasteners to fasten the guide retainer clip to the support bracket.

13. The assembly of claim 12, wherein the fasteners sheer during the vehicle impact such that support bracket breaks away from the guide retainer clip.

14. The assembly of claim 12, wherein the fastener are plastic rivets.

15. The assembly of claim 12, wherein the guide retainer clip is provided with a plurality of holes corresponding to the plurality of holes on the support bracket such that the fastener fastens the guide retainer clip to the support bracket.

16. A collapsible column housing in a steering column assembly for a motor vehicle adapted to collapse away from a vehicular operator during a vehicle impact, the column housing comprising:

a collapsible region defined in the column housing wherein the collapsible region is capable of collapsing in an axial direction away from the vehicular operator under a predetermined load during the vehicle impact;

a support bracket attachable to the column housing; and

a guide retainer clip fastenable to the support bracket for attaching the column housing to the motor vehicle, wherein the guide retainer clip guides the movement of the column housing in an axial direction away from the vehicular operator during the vehicle impact under the predetermined load during the vehicle impact such that the guide retainer clip remains attached to the motor vehicle during the vehicle impact.

17. The column housing of claim 16, wherein the collapsible region is formed by placing flat plastic ribs between walls of the column housing.

18. The column housing of claim 17, wherein the flat plastic ribs are placed parallel to each other such that the walls absorb energy as the collapsible region collapses under the predetermined load.

19. The column housing of claim 16, wherein the support bracket is a L-shaped bracket having a first face and a second face substantially perpendicular to the first face.

20. The column housing of claim 19, wherein the first face is attached to the column housing.

21. The column housing of claim 19, wherein the second face is attachable to the motor vehicle.

22. The column housing of claim 16, wherein the support bracket defines a slot to slidably receive an attachment bolt from the motor vehicle.

23. The column housing of claim 22, wherein the guide retainer clip defines an aperture corresponding to the slot on the support bracket, such that the aperture is adapted to receive the attachment bolt to attach the support bracket to the motor vehicle.

24. The column housing of claim 16, wherein the support bracket defines a plurality of holes to receive fasteners to fasten the guide retainer clip to the support bracket.

25. The column housing of claim 24, wherein the fasteners sheer during the vehicle impact such that support bracket breaks away from the guide retainer clip.

26. The column housing of claim 24, wherein the fastener are plastic rivets.

27. The column housing of claim 24, wherein the guide retainer clip is provided with a plurality of holes corresponding to the plurality of holes on the support bracket such that the fastener fastens the guide retainer clip to the support bracket.

28. A method of manufacturing a steering column assembly for a motor vehicle adapted to collapse away from a vehicular operator during a vehicle impact, the method comprising:

providing a steering wheel operable by the vehicular operator;

attaching one end of a steering shaft to the steering wheel;

housing the steering shaft in a column housing for;

defining a collapsible region in the column housing;

attaching a support bracket to the column housing;

fastening a guide retainer clip to the support bracket; and

collapsing the column housing such that the collapsible region collapses in an axial direction away from the vehicular operator under a predetermined load and the guide retainer clip guides the movement of the column housing in an axial direction away from the vehicular operator.

29. The method of claim 28, further comprising the step of telescopically collapsing the steering shaft away from the vehicular operator independent of the column housing.

30. The method of claim 28, further comprising the step of reinforcing the column housing using x-shaped plastic ribs between walls of the column housing.

31. The method of claim 28, forming the collapsible region by placing flat plastic ribs between walls of the column housing.

32. The method of claim 31, further comprising the step of placing flat plastic ribs parallel to each other such that the walls absorb energy as the column housing collapses under the predetermined load.

33. The method of claim 28, further comprising the step of defining a slot in the support bracket to slidably receive an attachment bolt from the motor vehicle.

34. The method of claim 33, further comprising the steps of:

defining an aperture on the guide retainer clip corresponding to the slot on the support bracket such that the aperture is adapted to receive the attachment bolt from the motor vehicle; and

attaching the support bracket to the motor vehicle, such that during vehicle impact the guide retainer clip remains attached to the motor vehicle.

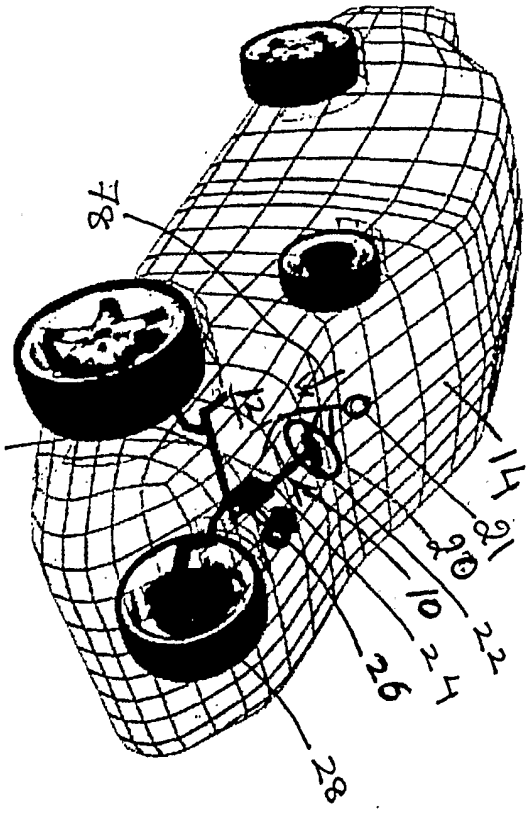

FIGURE 1

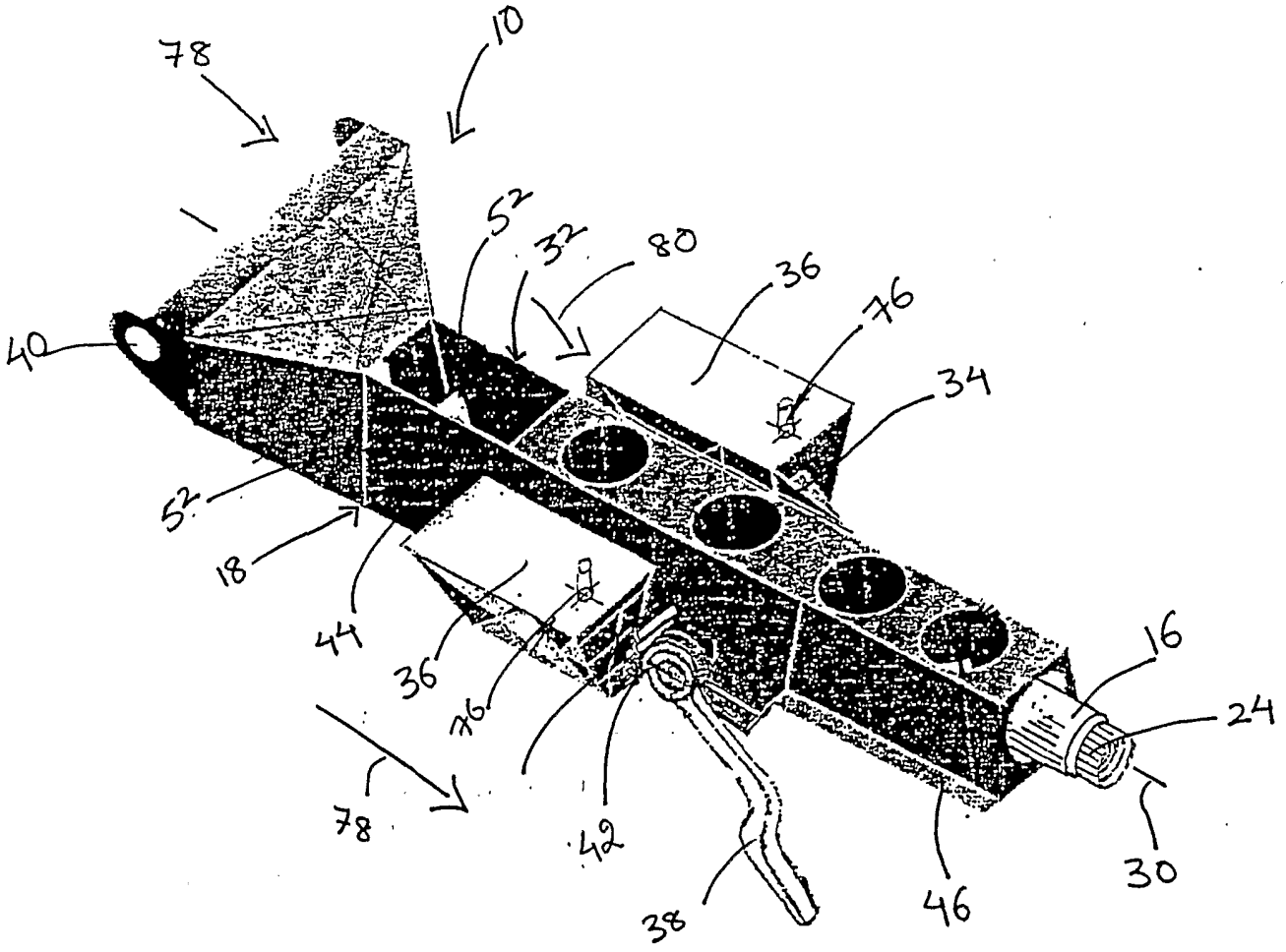

FIGURE 2

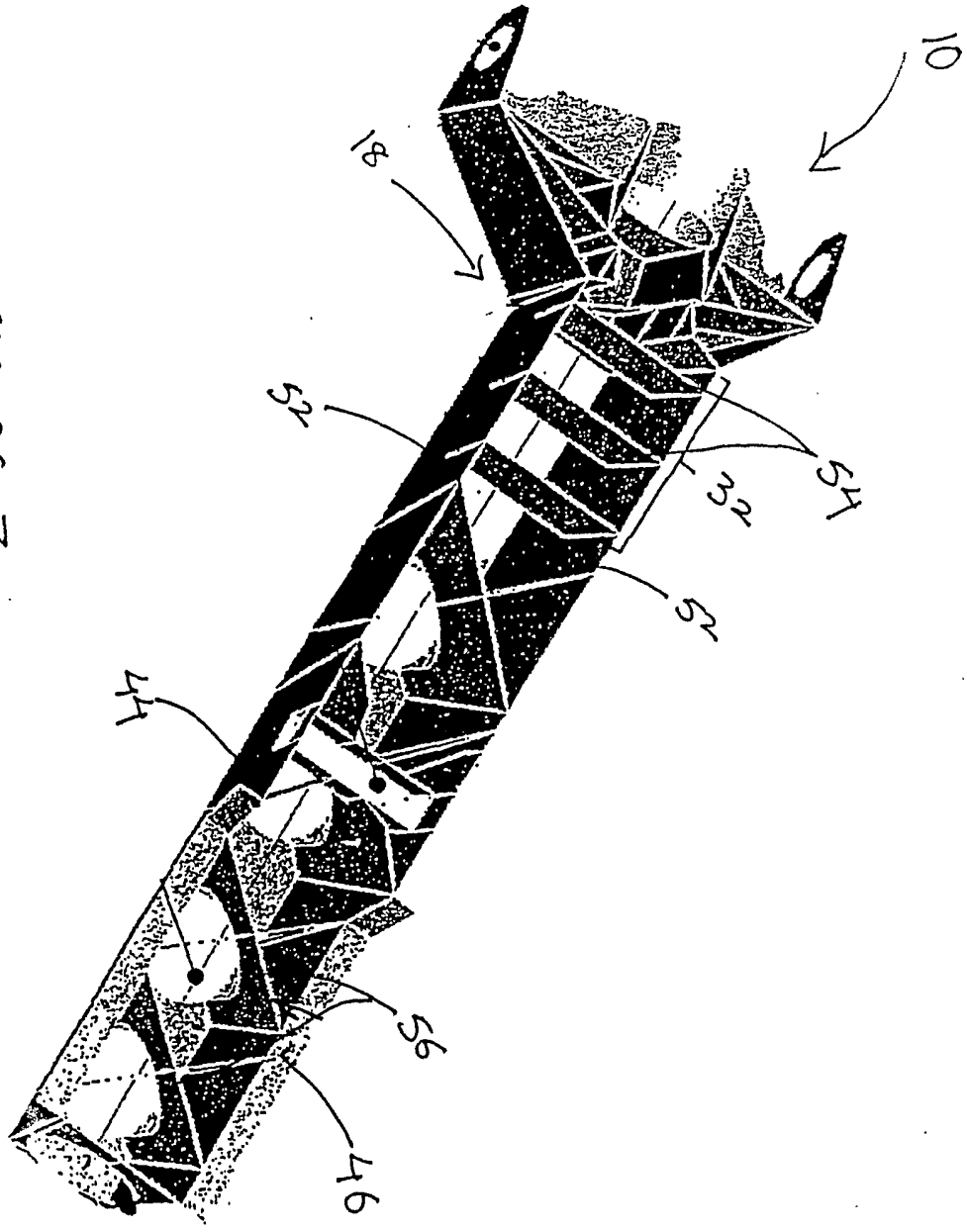

FIGURE 3

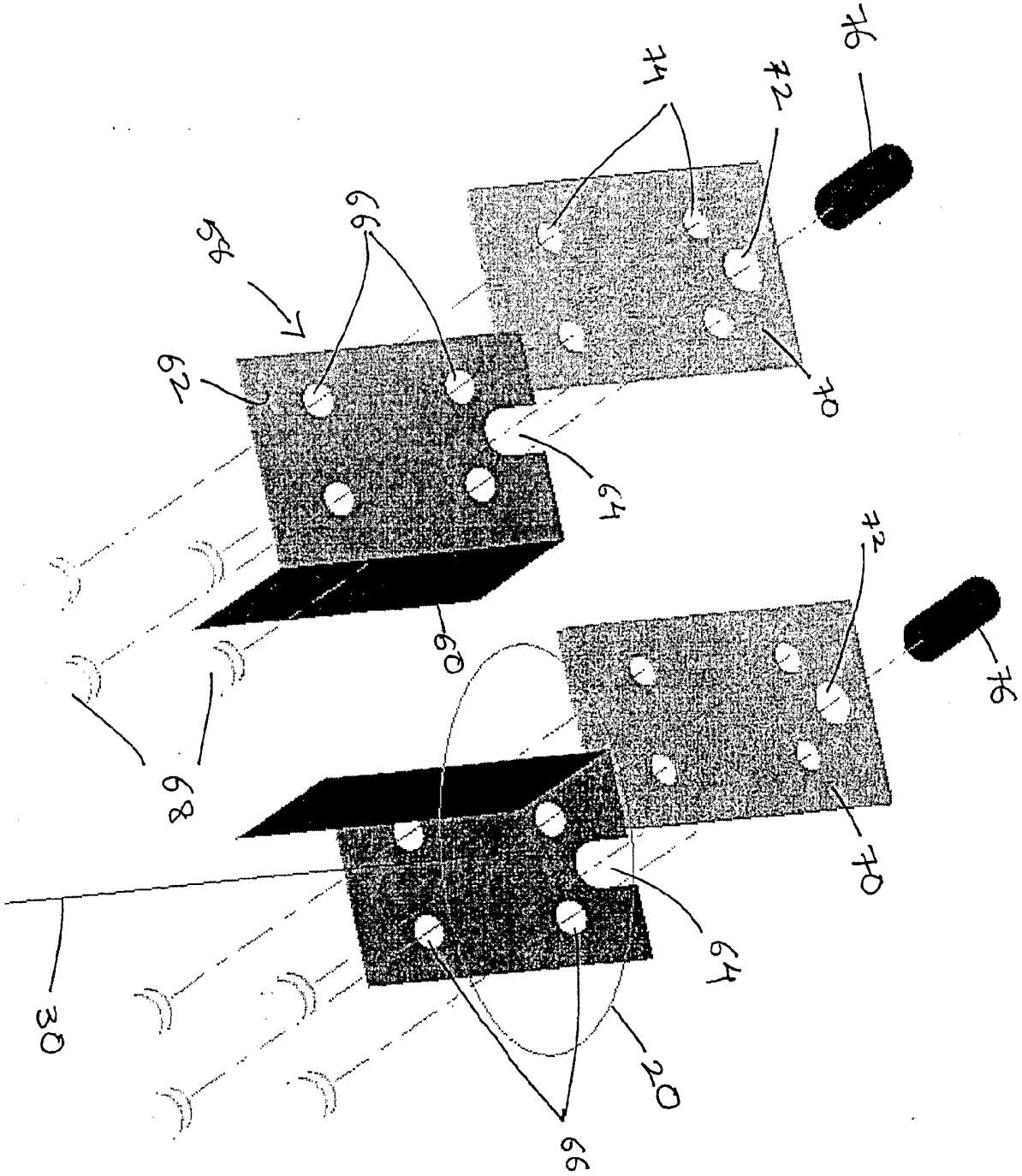

FIGURE 4

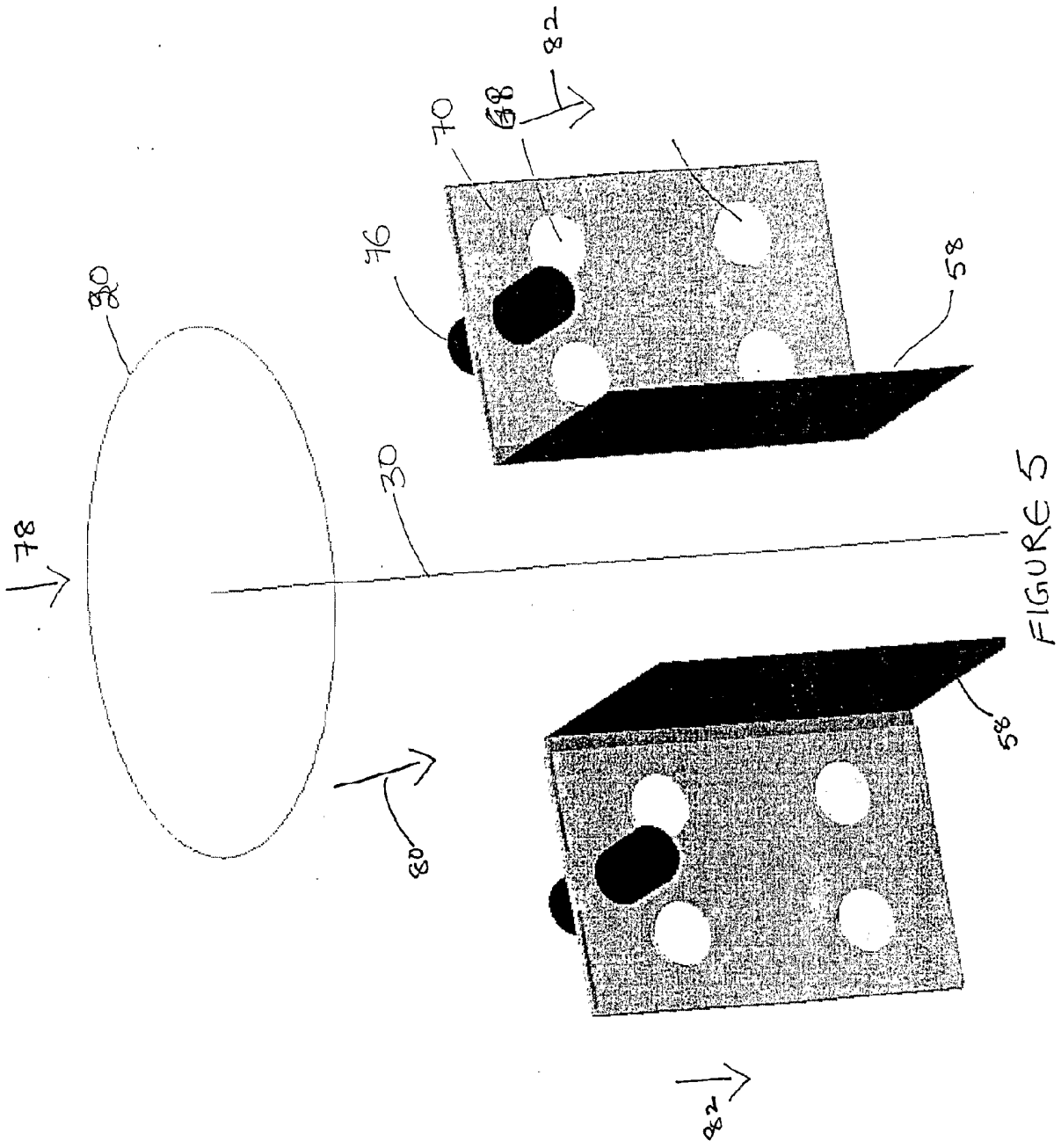

FIGURE 5