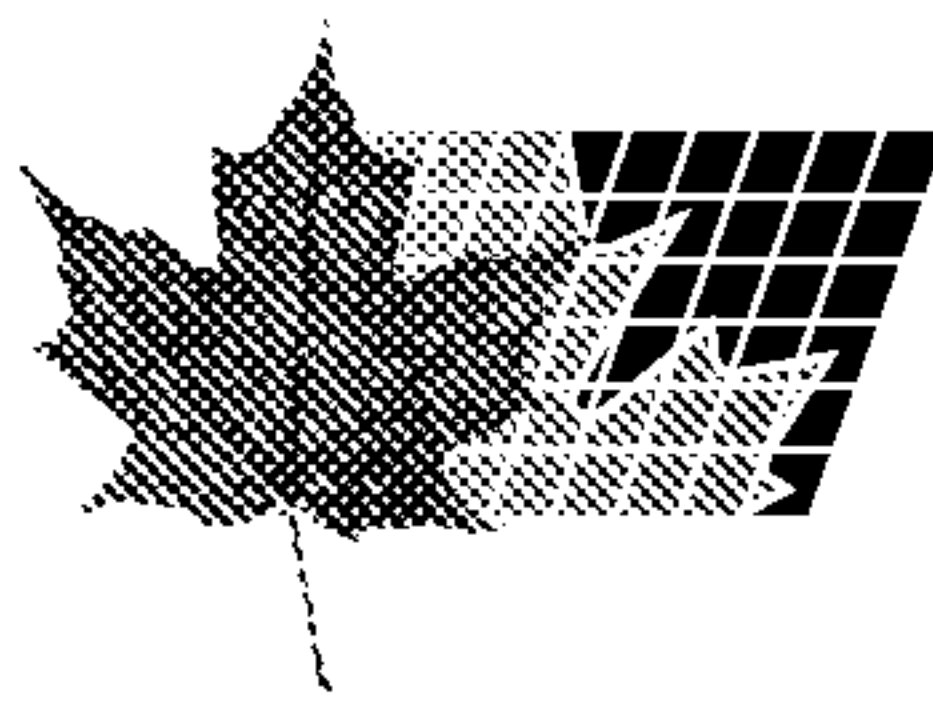
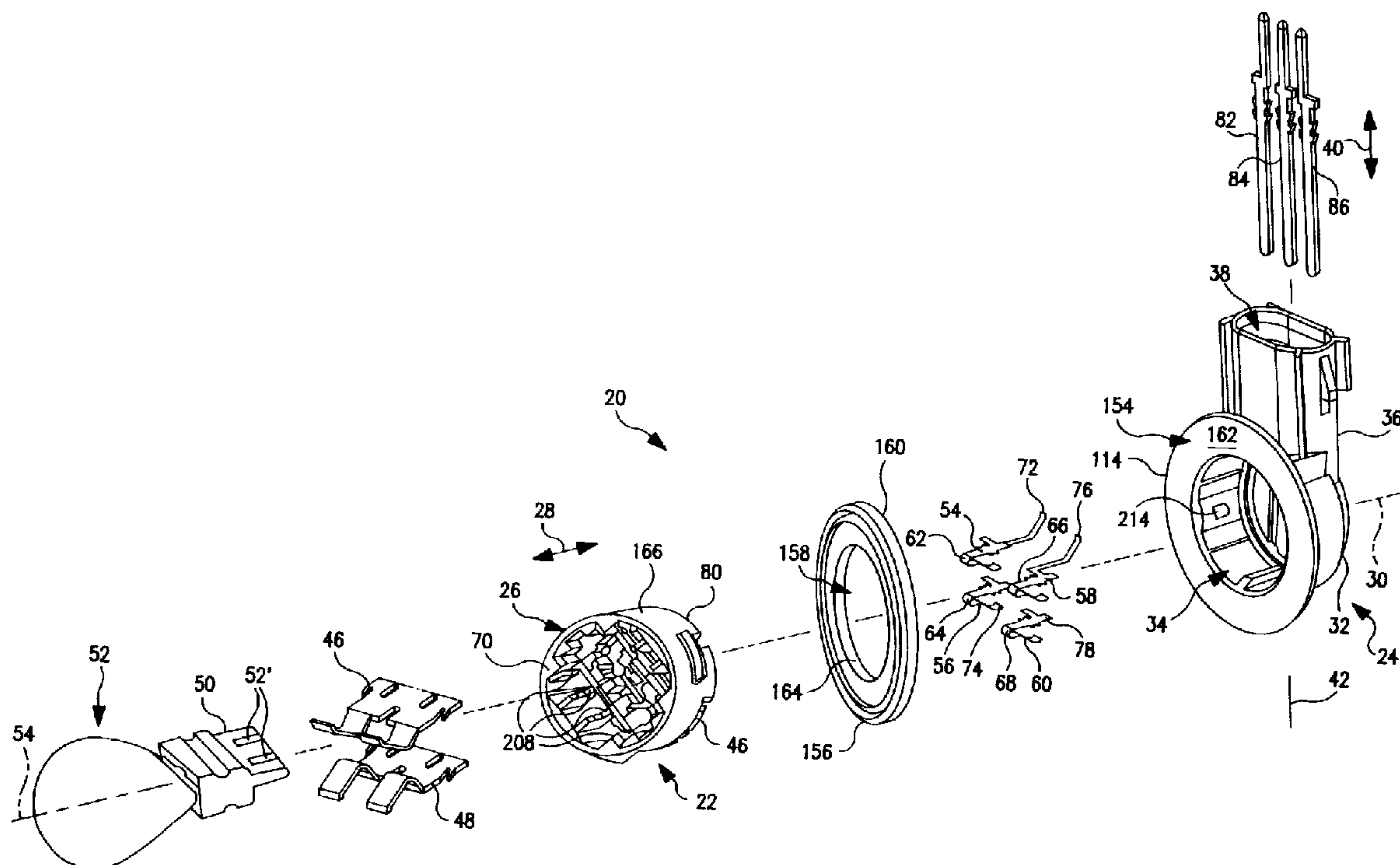




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(54) **ANGLED LAMP SOCKET**



(57) An angled lamp socket is provided that includes a body and a housing. The body contains therein opposing lamp retaining clips and a plurality of lamp contact members. The housing contains therein a plurality of terminal members. Respective lamp contact members are connected electrically to respective terminal members within a portion of the housing. When a lamp is inserted into the socket, the horizontal axis of the lamp will extend at an angle in relation to the terminal members. In a preferred embodiment, such angle is 90° thereby providing a right angle lamp socket. Each electrical connection may be a weld, or a spring biased engagement, between the lamp contact members and respective terminal members. The electrical connection is such that there is no need for any special opening, and cover thereof, to gain access to the inside of the lamp socket.

ABSTRACT

An angled lamp socket is provided that includes a body and a housing.

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The body contains therein opposing lamp retaining clips and a plurality of lamp contact members. The housing contains therein a plurality of

terminal members. Respective lamp contact members are connected electrically to respective terminal members within a portion of the housing. When a lamp is inserted into the socket, the horizontal axis of

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the lamp will extend at an angle in relation to the terminal members. In a preferred embodiment, such angle is 90° thereby providing a right angle

lamp socket. Each electrical connection may be a weld, or a spring biased engagement, between the lamp contact members and respective

terminal members. The electrical connection is such that there is no need

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for any special opening, and cover thereof, to gain access to the inside of the lamp socket.

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ANGLED LAMP SOCKET

CROSS-REFERENCE TO RELATED APPLICATIONS

5 S.N.: 09/149,415, filed 09/08/98, and assigned to the assignee of the present invention, contains related subject matter and is hereby incorporated by reference.

TECHNICAL FIELD

10 The present invention relates to a lamp socket, and more particularly to an angled lamp socket for a wedge base lamp used in a lighting module of a motor vehicle wherein the longitudinal axis of the lamp extends in a first direction and the terminals of the lamp socket generally extend in a second direction that is at an angle relative to the first direction. For
15 example, the angled lamp socket of the present invention is particularly useful in front and rear automobile directional and safety lighting applications.

BACKGROUND ART

20 The need for a lamp socket wherein the axis of the horizontal axis of the lamp inserted therein extends in one direction and the terminals of the lamp socket extend in another direction at an angle thereto is well known. Such a lamp socket is herein referred to as an angled lamp
25 socket. One such angled lamp socket is referred to in the lamp industry as a right angle lamp socket. In such a lamp socket, the horizontal axis of the lamp and the terminals of the lamp socket are oriented at 90° relative to each other.

30 It is presently known to provide an angled lamp socket that is satisfactory for use in motor vehicle applications. Examples of such angled lamp sockets are illustrated in U.S. patent nos. 5,197,187 and

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5,411,407 (these patents are commonly owned with the instant application and are incorporated herein by reference). However, such lamp sockets have a profile height that may be greater than is often desired. For example, one known angled lamp socket is fabricated by welding the contacts that engage the leads of the lamp, to the socket terminals on the opposite or bottom side of the socket. Subsequent to welding, a sealant is provided to protect the electrical connections within the lamp socket from environmental considerations. A cover is placed over the weld and the sealant to improve the appearance of the lamp socket. However, the use of this additional part increases the profile height of the lamp socket and adds to the cost of fabrication thereof. In addition, the welding of the contacts to the terminals in such known lamp sockets has been limited to a conventional welding process wherein the welding is effected from the bottom and externally of the lamp socket. Heretofore, resistance welding has not been feasible within such lamps.

DISCLOSURE OF THE INVENTION

It is an object of the invention to obviate the disadvantages of the prior art.

It is an object of the present invention to provide an improved angled lamp socket.

It is another object of the present invention to provide an angled lamp socket that is less costly to fabricate than those heretofore provided.

Another object of the present invention is to provide an angled lamp socket that eliminates the need for the conventional cover typically used to enclose the contact/terminal weld within the lamp socket.

Yet another object of the present invention is to provide an angled lamp

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socket wherein the contacts and terminals thereof are welded together at an area facing the top side of the lamp socket.

5 A further object of the present invention is to provide an angled lamp socket wherein the contacts and terminals thereof may be welded together within the lamp socket.

10 Another object of the present invention is to provide an angled lamp socket wherein the contacts and terminals thereof may be welded together by resistance welding, if desired.

It is a further object of the present invention to provide an angled lamp socket having improved life expectancy.

15 Yet another object of the present invention is to provide an improved method for assembling the angled lamp socket of the present invention.

20 This invention achieves these and other objects by providing an angled lamp socket that comprises a body having a housing attached thereto. At least one lamp retaining member is provided within the body and is structured and arranged to retain a lamp, having a longitudinal lamp axis, such that the lamp axis will extend in a first direction when the lamp is inserted into the body. A plurality of lamp contact members is provided at least a portion of each of that is in the body. Each lamp contact member includes a contact lead that comprises a contact lead surface. A 25 plurality of terminal members is provided at least a portion of each of that is in the housing. Each terminal member comprises a terminal lead surface that engages a respective contact lead surface in the housing. Each terminal generally extends in a second direction, such second direction being at an angle to the first direction. Each respective contact lead surface is electrically connected to a respective terminal lead surface by (a) a weld at an interface of each respective contact lead surface and a 30

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respective terminal lead surface, such weld facing the front end of the body, or (b) a spring biased engagement at an interface of each respective contact lead surface and a respective terminal lead surface. A method for assembling an angled lamp socket is also provided.

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BRIEF DESCRIPTION OF THE DRAWINGS

This invention may be clearly understood by reference to the attached drawings in that like reference numerals designate like parts and in that:

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FIG. 1 is an exploded view of an angled lamp socket in accordance with one embodiment of the present invention with a lamp added;

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FIG. 2 is a perspective view of a lamp, and of lamp contact members and terminal members of one embodiment of the present invention, illustrating their operational relationship;

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FIG. 3 is a perspective view of a lamp contact member in accordance with one embodiment of the present invention;

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FIG. 4 is a perspective view of a lamp contact member in accordance with another embodiment of the present invention;

FIG. 5 is a perspective front view of the housing illustrated in FIG. 1 partially illustrating lamp contact members and terminal members therein;

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FIG. 6 is a front view of the body illustrated in FIG. 1;

FIG. 7 is a rear view of the body illustrated in FIG. 1;

FIG. 8 is a perspective view of the lamp retaining members illustrated in

FIG. 1;

FIG. 9 is a sectional view taken along lines 9-9 of FIG. 5 with all of the remaining components of the angled lamp socket of FIG. 1 being illustrated; and

FIG. 10 is a perspective rear view of a body in accordance with another embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

For a better understanding of the present invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following disclosure and appended claims taken in conjunction with the above-described drawings.

The embodiment of this invention that is illustrated in the drawings is particularly suited for achieving the objects of this invention. FIG. 1 illustrates a lamp socket 20 embodying the present invention. Lamp socket 20 provides a two piece insulator that is in the form of first and second slidably engaging components including a body 22 and a housing 24. As will be apparent herein, the two piece insulator simplifies design and assembly of the lamp socket. The body component 22 includes a body cavity 26 that extends in a direction 28 of an axis 30.

Housing 24 includes a first portion 32 having a first housing cavity 34 and a second portion 36 having a second housing cavity 38. The first housing cavity 34 extends in the direction 28 of axis 30. The second housing cavity 38 extends in a direction 40 of an axis 42. The axis 42 extends at an angle 44, illustrated in FIG. 2, in relation to axis 30. In the embodiment illustrated in FIGS. 1 and 2, angle 44 is 90°, and the angled lamp socket 20 is a right angle lamp socket. The body 22 is connected to

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the first portion 32 of housing 24 as described hereinafter.

5 The lamp socket 20 includes two lamp-retaining members in the form of a first resilient retention member 46 and an opposite second resilient retention member 48. In a preferred embodiment, the resilient retention members are metal although other materials may be used. Retention members 46 and 48 are structured and arranged for insertion into the body cavity 26 to retain a wedge-like base 50 of a lamp 52, such as a conventional S8 wedge base lamp, so that the lamp longitudinal axis 54 extends in the direction 28 when the lamp is inserted in the body cavity 26.

15 The lamp socket 20 includes a plurality of lamp contact members 54, 56, 58 and 60 in the body cavity 26. Each lamp contact member 54, 56, 58, 60 includes an end 62, 64, 66, 68, respectively, facing the front end 62 of the body 22 and adapted to engage a respective lead wire 52' of lamp 52, and an opposite end 72, 74, 76 and 78, respectively, extending out of the body component 22 at rear end 80 of the body.

20 The lamp socket 20 includes a plurality of terminal members 82, 84, 86 at least a portion of each of that is in the housing 24. In the embodiment illustrated in FIG. 1, the entire length of the terminal members 82, 84, 86 is in the housing 24. Each terminal member 82, 84, 86 extends from housing cavity 34 to housing cavity 38 generally in the direction 40 of the axis 42. Each terminal member engages a respective lamp contact member in the housing cavity 34 as described hereinafter.

30 FIG. 2 illustrates the relationship between the lamp contact members 54, 56, 58 and 60 and the terminal members 82, 84 and 86. Lamp contact members 54 and 56 are ground contacts that are electrically connected to a common ground terminal member 82 at respective contact ends 72 and 74. Lamp contact member 58 is a minor contact that is electrically

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connected to the minor terminal member 84 at end contact end 76.
Lamp contact member 60 is a major contact that is electrically connected
to the major terminal member 86 and contact end 78.

5 FIG.3 illustrates the configuration of the ground lamp contact member
54 and 56 and the major lamp contact member 60. Since each of such
lamp contact members is identical only the major lamp contact member
60 is illustrated in FIG. 3. The lamp contact member 60 includes an end
10 68 that engages and is electrically connected to a major lamp filament of
the lamp 52 and an end 78 that engages and is electrically connected to
the major terminal member 86. The end 68 is turned back towards an
intermediate length 88 and thereby provides a resilient end 68 that will
deflect when the lamp 52 is force fit into body cavity 26 thereby causing
the end 68 to exert a satisfactory force against the major lamp filament.
15 The end 78 includes a contact lead 90 that will extend from the body
cavity 26 when the angled lamp socket 20 is assembled. The contact
lead 90 includes a contact lead surface 92 that will engage a terminal
lead surface 94 of the major terminal 86 when the angled lamp socket 20
is assembled. The ends 68 and 78 of the lamp contact member 60 are
20 generally aligned with each other relative to axis 96. This, in
combination with the structure and arrangement of the body 22 and
housing 24, assures that the lamp contact member 60 will satisfactorily
engage the major lamp filament of the lamp 52 and the major terminal
member 86. In the embodiment illustrated in FIG. 3, the contact lead
25 surface 92 extends at an angle of 90° relative to axis 96. In one
embodiment, the contact lead surface 90 is 1.4 mm wide and the terminal
lead surface 94 is 2 mm wide. It will be readily apparent that the
foregoing comments are equally applicable regarding the ground lamp
contact members 54 and 56 and their relationship to respective ground
30 lamp filaments and terminal lead surface 94.

FIG. 4 illustrates the configuration of the minor lamp contact member

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58. Lamp contact member 58 includes an end 66 that engages and is electrically connected to a minor lamp filament of the lamp 52 and end 76 that engages and is electrically connected to the minor terminal member 84. The end 66 is turned back towards the intermediate length 98 and thereby provides a resilient end 66 that will deflect when the lamp 52 is force fit into body cavity 26 thereby causing the end 66 to exert a satisfactory force against the minor lamp filament of lamp 52. The end 76 includes a contact lead 100 that will extend from the body cavity 26 when the angled lamp socket 20 is assembled. The contact lead 100 includes a contact lead surface 102 that will engage a terminal lead surface 104 of the minor terminal 84 when the angled lamp socket 20 is assembled. The ends 66 and 76 of the lamp contact member 58 are not aligned with each but are offset relative to axis 106. In particular, a bridge 108 connects a length 110 and a length 112 thereby offsetting end 66 relative to end 76. Such offsets, in combination with the structure and arrangement of the body 22 and housing 24, assures that the lamp contact member 58 will satisfactorily engage the minor lamp filament of lamp 52 and the terminal lead surface 104. In the embodiment illustrated in FIG. 4, the contact lead surface 102 extends at an angle of 90° relative to axis 106. In one embodiment, the contact lead surface 102 is 1.4 mm wide and the terminal lead surface 104 is 2 mm wide.

In considering the relationship between each lamp contact member 54, 56, 58 and 60 and respective terminal member 82, 84 and 86, each contact lead surface engages a respective terminal lead surface in the housing cavity 34. For example, with reference to FIG. 5, the ends 72, 74, 76 and 78 of lamp contact members 54, 56, 58 and 60, respectively, extend into housing cavity 34 of housing 24 and engage respective terminals. In particular, ends 72 and 74 of lamp contact members 54 and 56 engage terminal member 82, and ends 76 and 78 of respective lamp contact members 58 and 60 engage respective terminal members 84 and 86. The nature of such engagement is illustrated in FIGS. 3 and 4. For

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example, in FIG. 3 the contact lead surface 92 of end 78 engages terminal lead surface 94 to provide a contact lead surface/terminal lead surface interface. Identical type contact lead surface/terminal lead surface interfaces are provided where the ends 72 and 74 engage terminal 82 and the end 76 engages the terminal 84.

Each respective lamp contact member is electrically connected to a respective terminal member by either (a) a weld adjacent a contact lead surface/terminal lead surface interface or (b) a spring biased engagement between each respective lamp contact member and respective terminal member at each respective contact lead surface/terminal lead surface interface. Typically, all of the lamp contact members will either be welded or spring loaded into engagement with a respective terminal member. FIG. 3 is illustrative of a lamp contact member 60 welded to a terminal 86 by a weld 108 adjacent the contact lead surface 92/ terminal lead surface 94 interface. FIG. 4 is illustrative of a lamp contact member 58 spring biased into engagement with a terminal member 84 at the contact lead surface 102/ terminal lead surface 104 interface. In the embodiment of FIG. 4, the resilient contact lead 100 is deflected in direction 110 as the contact lead surface 102 is compressed against the terminal lead surface 104 when the body 22 is mated with the housing 24 as described herein. In those instances where the contact lead surface 102 and the terminal lead surface 104 are tin-plated surfaces, a deflection that is sufficient to effect 4 Newtons of normal force in direction 112 between the contact lead surface and the terminal lead surface at the interface therebetween will be adequate to provide the desired electrical connection between the lamp contact member and the terminal contact member. In the embodiments illustrated in FIGS. 3 and 4, contact lead surfaces 92 and 102 are parallel to terminal lead surfaces 94 and 104, respectively, to facilitate providing a satisfactory electrical connection.

In the embodiment illustrated in FIG. 5, the housing cavity 34 extends

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from a housing front end 114 to a housing base 116. The housing cavity 38 extends from housing end 118 towards the housing cavity 34, the two housing cavities being separated by a housing wall 120. Although separated, the two housing cavities 34, 38 are also connected by at least one aperture extending through the wall 120 through that the terminal members extend. In the embodiment illustrated in FIG. 5, there are three apertures 122, 124 and 126. Terminal members 82, 84 and 86 extend from cavity 34 to cavity 38 through apertures 122, 124 and 126, respectively.

The lamp contact members are attached to the body 22 of the angled lamp socket 20 by inserting the ends 62, 64, 66 and 68 into the body cavity 26 at end 80. In this manner, the lamp contact members may be suspended in the body cavity 26. Such suspension may be effected by causing barbs that extend from each lamp contact member to engage respective internal surfaces of the body 22. For example, with reference to FIGS. 3 and 4, each lamp contact member, such as lamp contact members 58 and 60, include pairs of barbs 128 and 130 that extend laterally away from each other at the ends 66 and 68. FIGS. 6 and 7 illustrate the lamp contact members 54, 56, 58 and 60 having been inserted into body cavity 26 from end 80 towards end 70. In viewing FIG. 6, the ends 62, 64, 66 and 68 appear to be coming out of the sheet of paper and the ends 72, 74, 76 and 78 appear to be going into the sheet of paper. In viewing FIG. 7, the ends 62, 64, 66 and 68 appear to be going into the sheet of paper and the ends 72, 74, 76 and 78 appear to be coming out of the sheet of paper. With reference to FIG. 7, during such insertion, the ends 62, 64, 66 and 68 are inserted into respective slots 132 located in body cavity 26. Slots 132 provide support for the lamp contact members and are structured and arranged to also facilitate guiding the lamp contact members into alignment with respective terminal lead surfaces. With reference to FIG. 6, during such insertion, the ends 62, 64, 66 and 68 are inserted between respective walls 134,

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134' located in body cavity 26. The spacing between each pair of walls 134, 134' is such that upon insertion of a respective end 62, 64, 66 and 68, barbs 128 and 130 of each end are force fit between a respective pair of walls 134, 134' to affix the lamp contact members within the body cavity 26.

FIG. 8 is illustrative of one type of resilient retention member of the present invention. FIG. 8 illustrates resilient retention member 48.

Retention member 46 is identical thereto. Retention member 48 is in the form of a pair of retention beams represented by a first leg 136 and a second leg 138 joined together at one end 140 by a common cross bar 142. The provision of a common cross bar 142 simplifies the stamping and assembly process and adds strength to the retention members 46, 48.

Legs 136 and 138 extend from the cross bar 142 to respective distal ends. The end 140 includes resilient bearing surfaces 144 and 146 that engage respective angled ledges in body cavity 26 when the end 140 is inserted into the body cavity at front end 70 as described hereinafter.

When the two pairs of resilient retention members 46, 48 are inserted into the body cavity 26, the legs 136, 138 will extend from the cross bar 142 towards the body front end 70. In such an arrangement, the respective lamp base retaining portions 148, 150 at the distal ends of opposite retention beams 46, 48 will face each other as illustrated in FIG.

9. The resiliency of the legs 136, 138 and spacing between the opposing retaining portions 148, 150 will be structured and arranged to permit the wedge-type base 50 of the lamp 52 to be inserted between and grasped and retained in place by the opposing retaining portions. The use of

opposing resilient retention members 46, 48 facilitates positioning a lamp within the lamp socket 20 and improves lamp retention and stability in the lamp socket in that the wedge-like base 50 is contained at each of four corners of the base by a respective retaining portion 148, 150. The use of the metal spring-like retention members 46, 48 improves electrical conductivity and provides a reduction in lamp

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insertion force, yet maintains lamp withdrawal force to provide satisfactory containment of the wedge-type base 50.

5 The angled lamp socket of the present invention may include a gasket for sealing purposes. For example, the angled lamp socket 20 illustrated in FIG. 1 includes a flange 154 at the end 114 of the housing portion 32. An annular seal 156 is also provided. The body 22 extends through the opening 158 of the annular seal when the lamp socket is assembled. The annular seal is structured and arranged such that a surface 160 will
10 sealingly engage a flange surface 162, and a surface 164 will sealingly engage an outer surface 166 of the body 22, when the angled lamp socket 20 is in a use mode as described herein.

15 In the embodiment illustrated in FIG. 5, the housing wall 120 includes recesses 168, 170 and 172. The housing base 116 includes grooves 174, 176 and 178. The terminal members 82, 84 and 86 include arms 180, 182 and 184, and barbs 186, 188 and 190, respectively. The arms 180, 182 and 184 mate with respective recesses 168, 170 and 172 to facilitate proper alignment of the terminal members with respective lamp contact
20 members. The terminal members 82, 84 and 86 are held in place by being press fit into respective grooves 174, 176 and 178. The grooves 174, 176, 178 serve to prevent side to side motion of the terminal members 82, 84 and 86, respectively, and to otherwise hold the terminal members in place. The barbs 186, 188 and 190 engage the inner walls of
25 respective apertures 122, 124 and 126 to further hold in place respective terminal members 82, 84 and 86.

30 The angled lamp socket of the present invention may include a sealant between the terminal members and the aperture(s) in the housing wall that separates the first housing portion from the second housing portion. For example, the angled lamp socket 20 illustrated in FIG. 5 comprises pockets 192, 194 and 196 adjacent respective recesses 168, 170 and 172.

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Pockets 192, 194 and 196 may be about 1.5 mm deep. A sealant 198, 200 and 202 is provided in respective pockets 192, 194 and 196.

5 The method of assembling the angled lamp socket of the present invention will now be described with reference, for example, to the angled lamp socket 20 illustrated in the drawings.

10 The body 22 is prepared by inserting the resilient retention members 46 and 48 into the body cavity 26 at end 70. For example, in the embodiment illustrated in FIG. 9, the retention members 46 and 48 are inserted into respective slots 206 and 208 provided within the cavity 26. As the retention members are inserted into body cavity 26 towards end 80, the resilient bearing surfaces 144, 146 engage respective angled ledges 208 provided within the body cavity 26. The resilient bearing
15 surfaces 144 and 146, and the angled ledges 208, are structured and arranged such that the opposing resilient retention members 46 and 48 will be urged towards each other to provide spring loaded opposing pairs of lamp base retaining portions 148, 150 that engages opposite surfaces of the lamp base 50 to firmly hold the lamp 52 in place. When a lamp 52
20 is inserted into the body cavity 26, the lamp axis 54 will extend in the direction 28 of the body axis 30.

The body 22 is further prepared by inserting a plurality of lamp contact members into the body cavity 26 such that each contact lead surface
25 extends away from the end 70 of the body 22. For example, in the embodiment illustrated in FIGS 6 and 7, the ends 62, 64, 66 and 68 of body contact members 54, 56, 58 and 60 are inserted into respective slots 132 and urged towards end 70 until the lamp contact members are in place. For example, in the embodiment illustrated in FIG. 6, each lamp
30 contact member is in place with the barbs 128 and 130 engaging respective walls 134, 134'.

5 The housing 24 is prepared by inserting a plurality of terminal members into the housing such that each terminal lead surface extends towards the end 114 of the housing. For example, in the embodiment illustrated in FIG. 5, the terminal members 82, 84 and 86 are inserted into housing cavity 38, then through respective apertures 122, 124 and 128 and into housing cavity 34. During such insertion, the terminal members 82, 84 and 86 are press fit into grooves 174, 176 and 178. The terminal members are inserted into the housing 24 until the arms 180, 182 and 184 are mated with respective recesses 168, 170 and 172, and barbs 186, 188 and 190 engage inner walls of respective apertures 122, 124 and 126.

15 The body is then inserted into the housing by inserting a portion of the body into a housing cavity and engaging each terminal lead surface with a respective contact lead surface thereby providing respective contact lead surface/terminal lead surface interfaces. When an annular gasket is used, the body is first inserted through the gasket. For example, with reference to FIGS. 1 and 9, the end 80 of the body 22 is inserted through opening 158 of the annular gasket 156 and then into the housing cavity 34 until the contact lead surfaces, such as surfaces 92 and 102 engage respective terminal lead surfaces, such as 94 and 104 as illustrated in FIGS. 2, 3, 4, 5 and 9 (In FIG. 9, the terminal member 84 is not visible, it being blocked by terminal member 86).

25 After the body is inserted into the housing in this manner, each contact lead surface is connected electrically to a respective terminal lead surface. In the embodiment illustrated in FIG. 9, such electrical connection may be effected by inserting the body 22 into housing cavity 34 sufficiently to deflect each contact lead as illustrated in FIG. 4 with respect to contact lead 100 so as to provide a satisfactory normal force between each respective contact lead surface and a respective terminal lead surface at each respective contact lead surface/terminal lead surface

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interface. In such an embodiment, the outer surface 166 of body 22, and the inner surface 210 of the housing cavity 34 may be provided with one or more respective mating latch member 212 and 214 as illustrated in FIG. 1 that are structured and arranged to lock together the body and the housing when the contact leads have been deflected to the extent desired.

In the embodiment illustrated in the drawings, two latch members 212 and respective mating latch members 214 are provided. If desired, a weld may also be provided at each contact lead surface/terminal lead surface interface.

In the alternative, rather than relying upon a biased contact lead surface/terminal lead surface interface, each contact lead may be welded to a respective terminal adjacent respective contact lead surface/terminal lead surface interfaces. In such embodiment, after the body portion is inserted into the housing cavity so that each contact lead surface engages a respective terminal lead surface, respective contact leads and terminals are welded together. Such welding may be effected through the front end 70 of the body. For example, with reference to FIGS. 6 and 7, the body 22 includes openings or windows 216, 218, 220 and 222 that provide access to a respective contact lead surface and terminal lead surface such as contact lead surfaces 92 and 102 and respective terminal lead surfaces 94 and 104, respectively. By providing windows 216, 218, 220 and 222, welds such as weld 108 illustrated in FIG. 3 may be effected by, for example, focusing a laser at front end 70 of the body 22 through the body cavity 26 at each window to provide each respective weld. Each window may be, for example, 4mm by 4mm and extend through the body.

Alternatively, welding may be effected in a similar manner by resistance welding by applying electrodes through respective windows and placing one electrode on a contact lead and another electrode on a respective terminal lead to that the contact lead is to be welded.

A sealing step may be used to seal the terminal members within the housing cavity. For example, in the embodiment illustrated in FIG. 5, such sealing may be effected by providing a curable epoxy in the pockets 192, 194 and 196 of wall 120 of the housing 24 to form sealants 198, 200 and 202. Without limitation, a curable epoxy such as Nuvasil may be used.

When the angled lamp socket 20 is attached to a member 224 in a conventional manner as illustrated in FIG. 9, the annular gasket 156 will be compressed to the extent that gasket surface 160 will sealingly engage flange surface 162, and gasket surface 164 will sealingly engage outer surface 166 of body 22. When a lamp 52 is inserted into cavity 26, the angular lamp socket will be sealed from environmental features such as moisture by the annular gasket 156 and the sealants 198, 200 and 202 thereby protecting the electrical connections within the angular lamp socket.

The angular lamp socket of the present invention may be readily used when different focal lengths are required. This is accomplished merely by increasing the length of the body 22 and lamp contact members 54, 56, 58 and 60. The other features of the angular lamp socket 20, such as the positioning of the mating latch members 212 and 214, may remain the same. This allows for reduced tooling and inventory costs. In those instances where longer lamp contact members 54, 56, 58 and 60 are required to accommodate applications having a higher focal length, provision may be made for restraining the contact leads of the lamp contact members. For example, the body cavity may be provided with at least one rib. In addition, each lamp contact member may comprise a hook that engages such rib to restrain the contact lead of the contact member and to maintain alignment of the respective contact lead surface with a respective terminal lead surface. For example, body 22' of FIG.

10 includes a body cavity 26' that includes two ribs 226, 228. In order to simplify the drawing, only two lamp contact members 72' and 76' are illustrated. Except as described herein, lamp contact members 72' and 76' are longer than, but otherwise identical to, lamp contact members 72 and 76. Other than length, the difference is that lamp contact members 72' and 76' each include a hook 230 and 232, respectively, adjacent respective contact leads such as contact lead 100' of lamp contact member 76'. When a lamp socket is assembled using a body 22', the lamp contact members 72' and 76' are inserted at end 80' of body 22' into the body cavity 26' until the hooks 230 and 232 engage the rib 226. Such engagement provides support for and otherwise restrains the lamp contact members 72' and 76' within the body cavity 26' that facilitates positioning the contact lead surface for consistent welding.

Fabrication of the angled lamp socket of the present invention may be accomplished using conventional procedures. For example, the lamp contact members, lamp retention members and terminal members may be stamped from a metal sheet and then rolled and/or bent as required to form the desired configuration. In the embodiment as illustrated in the drawings, the lamp retention members are stainless steel and the lamp contact members and terminal members are brass. The body and housing may be molded from a plastic material. For example the body and housing illustrated in the drawings are molded from PPA (poly phthalamide) and PBT (poly butylene terephthalate), respectively. The seal may be molded from a thermoplastic elastomer. The sealant may be a curable liquid sealant such as an epoxy such as Nuvasil.

The embodiments that have been described herein are but some of several that utilize this invention and are set forth here by way of illustration but not of limitation. It is apparent that many other embodiments that will be readily apparent to those skilled in the art may be made without departing materially from the spirit and scope of this

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invention.

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS.**

5 1. An angled lamp socket, comprising:

a body having a front end and a rear end;

a housing attached to said body at said rear end;

10

at least one lamp retaining member within said body and structured and
arranged to retain a lamp to be inserted into said body at said front end
such that a longitudinal lamp axis of said lamp will extend in a first
direction when said lamp is inserted in said body.

15

a plurality of lamp contact members at least a portion of each of that is in
said body, each lamp contact member having a contact lead that
comprises a contact lead surface; and

20

a plurality of terminal members at least a portion of each of that is in said
housing, each terminal member comprising a terminal lead surface
engaging a respective contact lead surface in said housing, each terminal
generally extending in a second direction, said second direction being at
an angle to said first direction, each respective contact lead being
electrically connected to a respective terminal lead by one of (a) a weld
adjacent an interface of each respective contact lead surface and a
respective terminal lead surface, said weld facing said front end, and (b)
a spring biased engagement at an interface of each respective contact
lead surface and a respective terminal lead surface.

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2. The angled lamp socket of claim 1 wherein each contact lead
surface is parallel to a respective engaging terminal lead surface.

3. The angled lamp socket of claim 1 wherein each respective contact lead surface is electrically connected to a respective terminal lead surface by a spring biased engagement between each respective contact member and a respective terminal member, each contact lead being deflected to provide at least 4 Newtons of normal force between each respective contact lead surface and a respective terminal lead surface.

4. An angled lamp socket, comprising:

a body having a body cavity extending in a first direction of a first axis from a front end to a rear end;

a housing having a first portion having a first housing cavity and a second portion having a second housing cavity, said first housing cavity extending in said first direction of said first axis, said second housing cavity extending in a second direction of a second axis, said second axis extending at an angle to said first axis, and said rear end of said body being connected to said first portion;

at least one lamp retaining member at least a portion of that is in said body cavity, said at least one lamp retaining member being structured and arranged to retain a lamp to be inserted in said body cavity at said front end such that a longitudinal lamp axis of said lamp will extend in said first direction when said lamp is inserted in said body cavity;

a plurality of lamp contact members at least a portion of each of that is in said body cavity, each lamp contact member of said plurality of lamp contact member having a contact lead that extends from said body cavity and includes a contact lead surface; and

a plurality of terminal members at least a portion of each of that is in said

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housing, each terminal member of said plurality of terminal member
extending from said first housing cavity to said second housing cavity
generally in said second direction, each terminal member having a
terminal lead surface in said first housing cavity, each terminal lead
5 surface engaging a respective contact lead surface to provide a respective
contact lead surface/terminal lead surface interface, each respective
contact lead surface being electrically connected to a respective terminal
lead surface by one of (a) a weld adjacent each respective contact lead
surface/terminal lead surface interface, said weld facing said front end,
10 and (b) a spring biased engagement between each respective contact
member and a respective terminal member at each respective contact
lead surface/terminal lead surface interface.

5. The angled lamp socket of claim 4 wherein each contact lead
15 surface is parallel to a terminal lead surface with that said contact lead
surface forms a respective contact lead surface/terminal lead surface
interface.

6. The angled lamp socket of claim 4 wherein each respective
20 contact lead surface is electrically connected to a respective terminal lead
surface by spring biased engagement between each respective contact
member and a respective terminal member at each respective contact
lead surface/terminal lead surface interface, each contact lead being
deflected to provide at least 4 Newtons of normal force between each
25 respective contact lead surface and a respective terminal lead surface at
each respective contact lead surface/terminal lead surface interface.

7. The angled lamp socket of claim 6 wherein each contact lead
30 surface is parallel to a terminal lead surface with that said contact lead
surface forms a respective contact lead surface/terminal lead surface
interface.

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8. The angled lamp socket of claim 4 wherein said first housing cavity extends from a first housing end to a housing base, said body being connected to said first portion by said front end extending into said first housing cavity, each contact lead extending from said first body and into said first housing cavity, and further wherein said second housing cavity extends from a second housing end towards said first housing cavity, said first housing cavity and said second housing cavity being separated by a housing wall and being connected by at least one aperture extending through said housing wall, said plurality of terminal members extending from said first housing cavity to said second housing cavity by extending through said at least one aperture.

9. The angled lamp socket of claim 8 wherein said first housing end comprises a flange, and further including an annular seal through that said body extends, said annular seal being structured and arranged to have a first surface that sealingly engages said flange, and a second surface that sealingly engages an outer surface of said body, in a use mode of said angled lamp socket.

10. The angled lamp socket of claim 9 further including a sealant between said plurality of terminal members and said at least one aperture.

11. The angled lamp socket of claim 4 wherein said body cavity comprises at least one rib, and each lamp contact member comprises a hook that engages a rib of said at least one rib, said at least one rib and each hook being structured and arranged to maintain alignment of a respective contact lead surface with a respective terminal lead surface.

12. A method for assembling an angled lamp socket of the type wherein a longitudinal lamp axis of a lamp to be inserted into the front end of an angled lamp socket will extend at an angle to the terminal

members of the angled lamp socket, comprising the steps of:

inserting at least one lamp-retaining member into a body cavity of a body;

5

inserting a plurality of lamp contact members into said body cavity such that a contact lead surface of a contact lead of each lamp contact member extends away from a front of said body;

10

inserting a plurality of terminal members into a housing cavity such that a terminal lead surface of a terminal lead of each terminal member faces an opening of said housing;

15

inserting a portion of said body into said housing cavity at said opening and engaging each respective terminal lead surface with a respective contact lead surface providing respective contact lead surface/terminal lead surface interfaces; and

20

connecting electrically each respective contact lead surface to a respective terminal lead surface by one of (a) welding each respective contact lead surface to a respective terminal lead surface adjacent a respective contact lead surface/terminal lead surface interface so that the weld faces said front end, and (b) engaging each respective contact member and a respective terminal member with bias between each

25

contact lead surface/terminal lead surface interface.

13. The method of claim 12 further including the step of attaching said portion of said body to said housing.

30

14. The method of claim 12 wherein said body is of the type wherein said body cavity comprises a front end into that a lamp may be inserted and an opposite rear end, said step of inserting a portion of said body into

said housing cavity comprising the step of inserting said opposite rear end into said housing cavity, and wherein said connecting step comprises the step of welding from said front end each respective contact lead surface to a respective terminal lead surface adjacent a respective contact lead surface/terminal lead surface interface.

15. The method of claim 12 wherein said housing is of the type that includes a flange adjacent said housing cavity, and an annular gasket, and further including the step of inserting said portion of said body through said annular gasket before the step of inserting said portion of said body into said housing cavity.

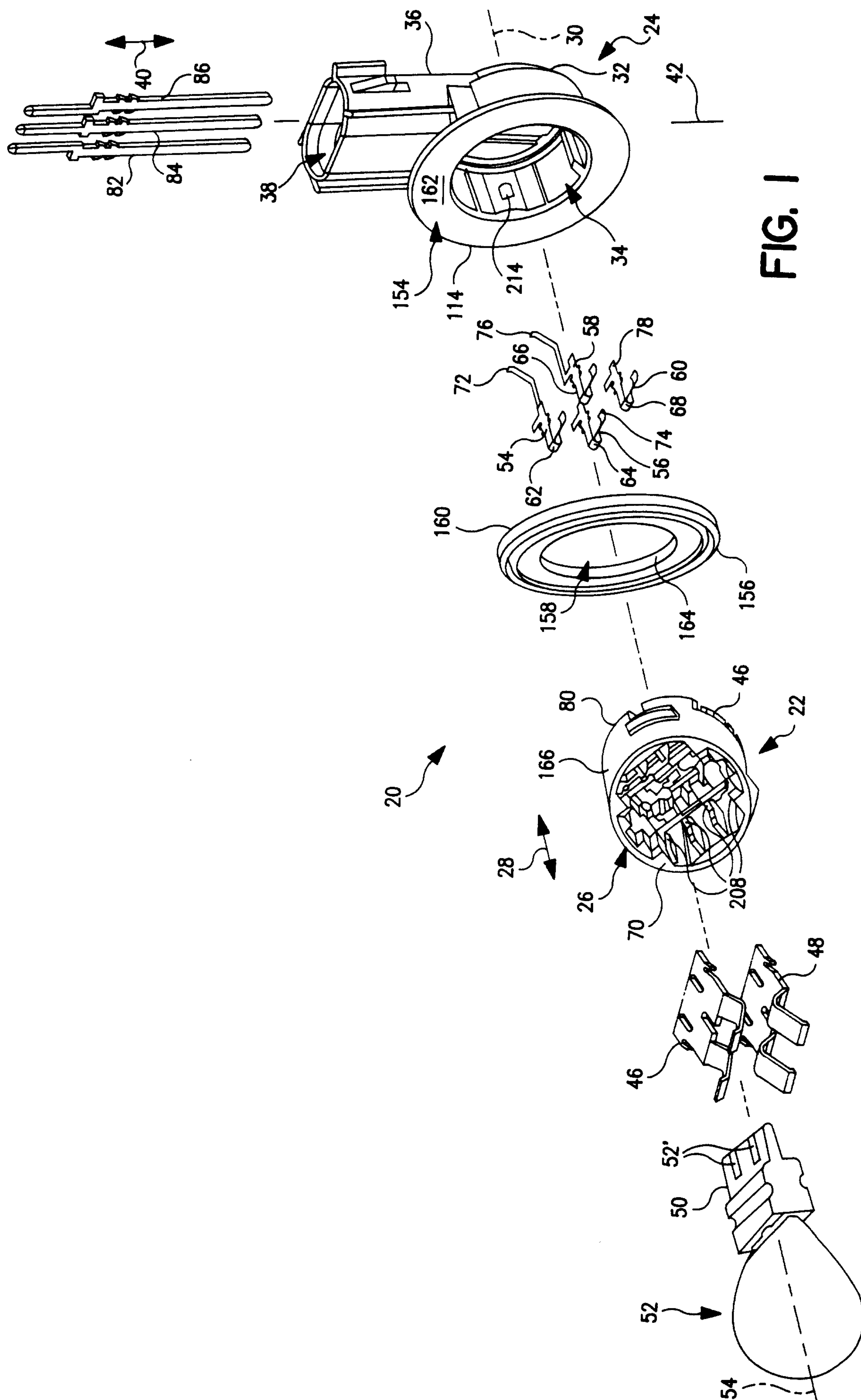
16. The method of claim 12 further including the step of sealing said plurality of terminals within said housing.

17. The method of claim 16 wherein said housing is of the type that includes a flange adjacent said housing cavity, and an annular gasket, and further including the step of inserting said portion of said body through said annular gasket before the step of inserting said portion of said body into said housing cavity.

18. The method of claim 12 wherein said connecting step comprises the step of deflecting each contact lead so as to provide at least 4 Newtons of normal force between each respective contact lead surface and a respective terminal lead surface at each respective contact lead surface/terminal lead surface interface.

19. The method of claim 12 wherein said body is of the type that comprises at least one rib in said body cavity, and further wherein said step of inserting said plurality of lamp contact members comprises the step of hooking a portion of each lamp contact member with said at least one rib.

20. The method of claim 18 further including the step of attaching said portion of said body to said housing.



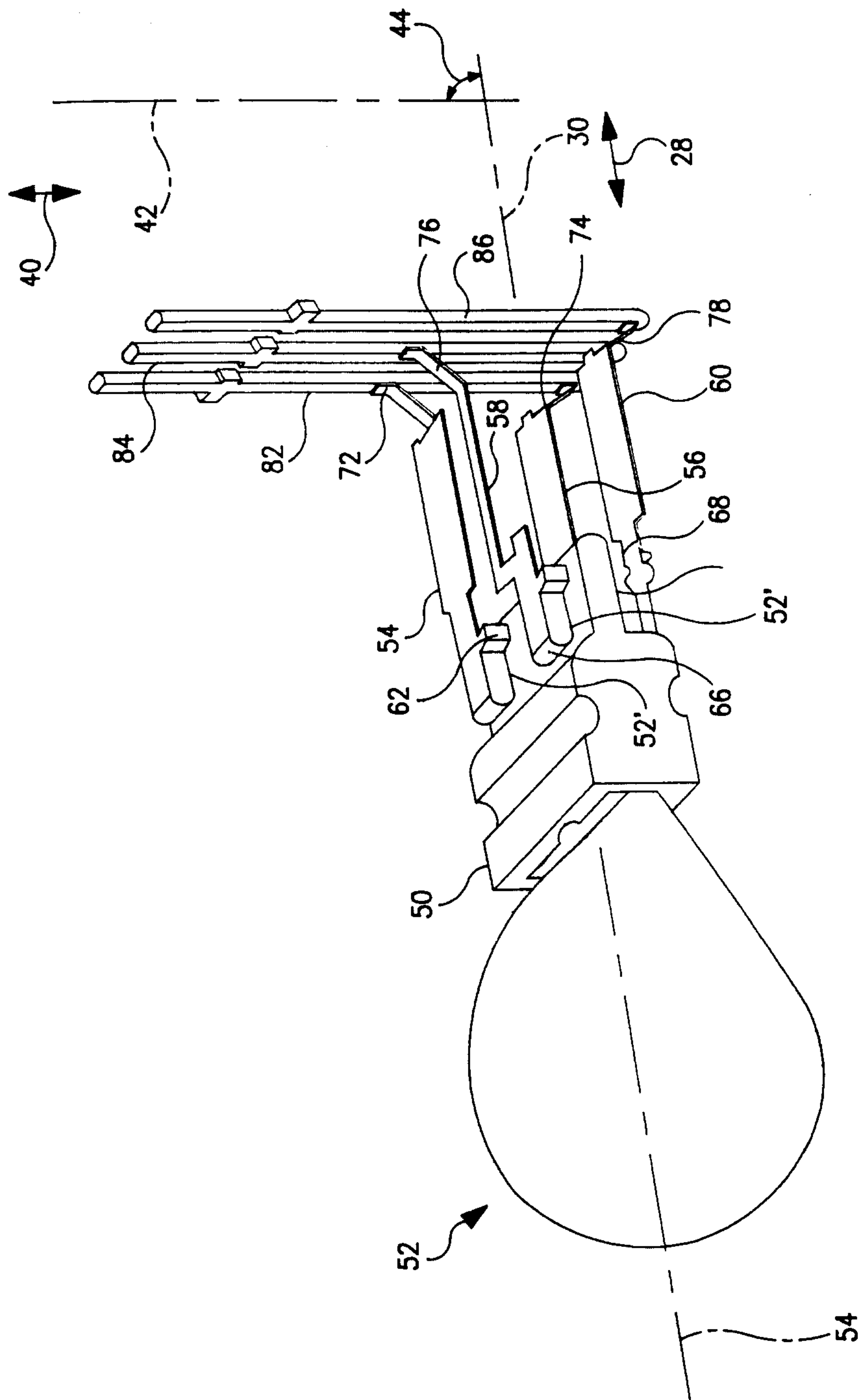
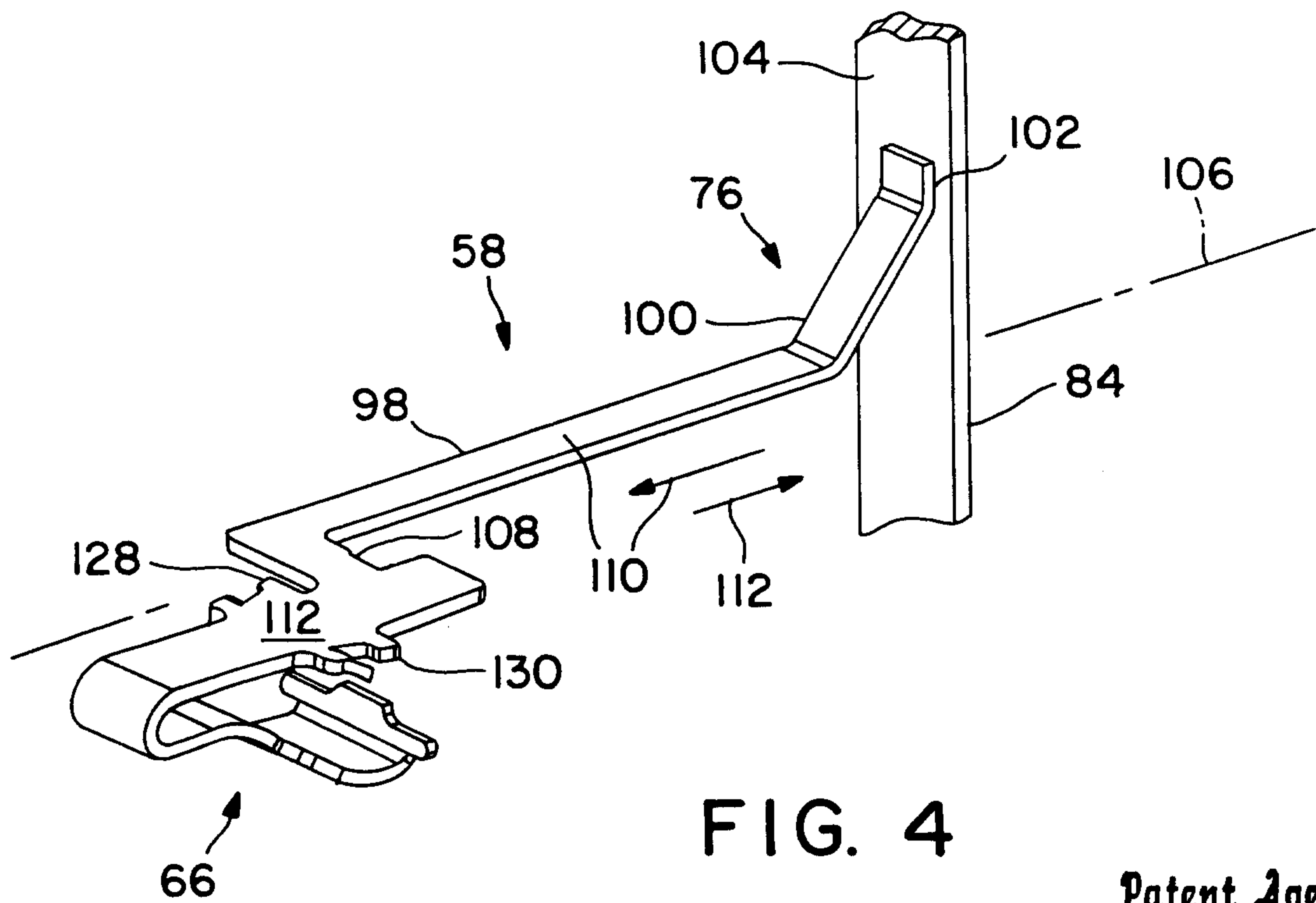
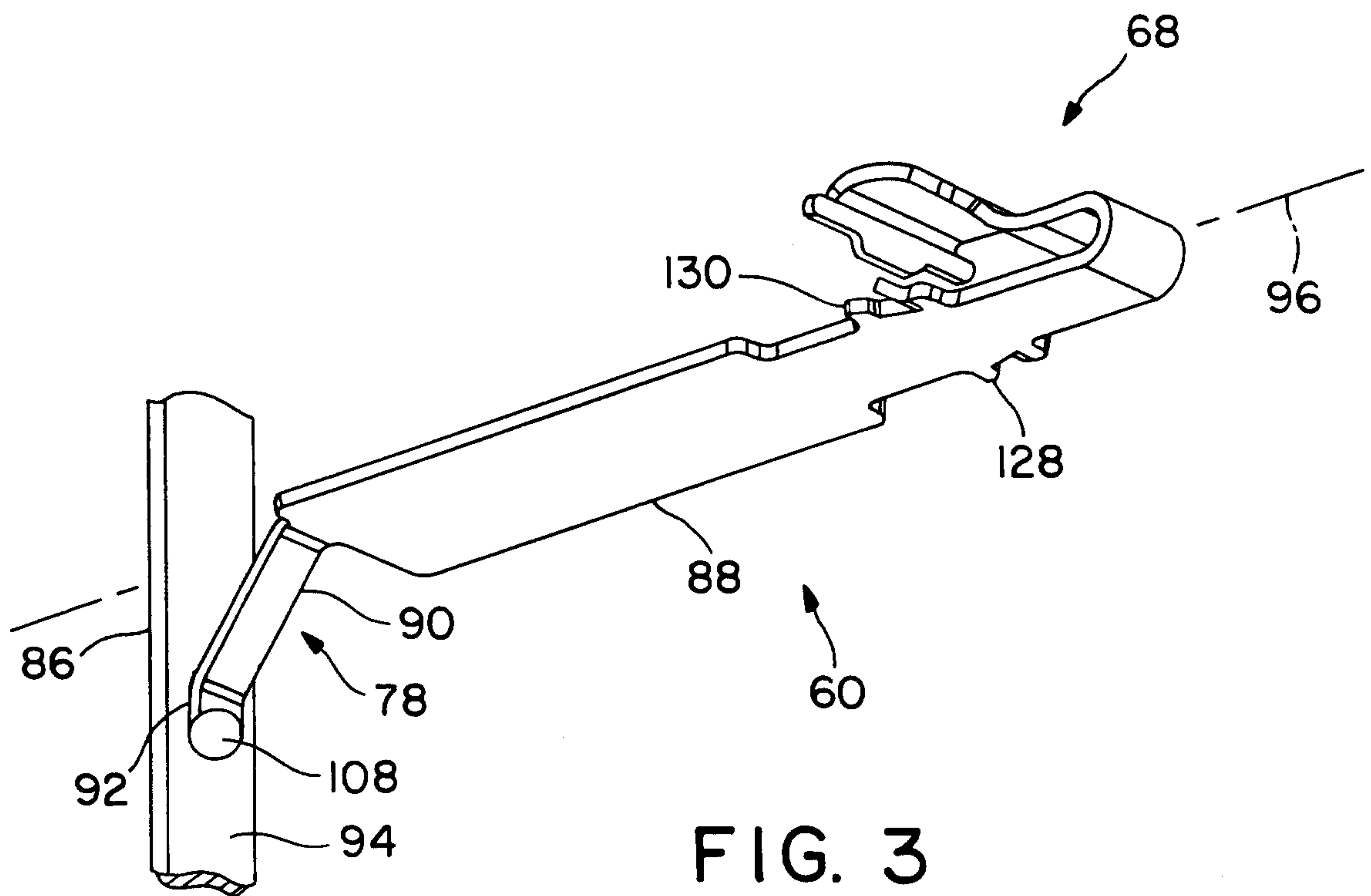


FIG. 2

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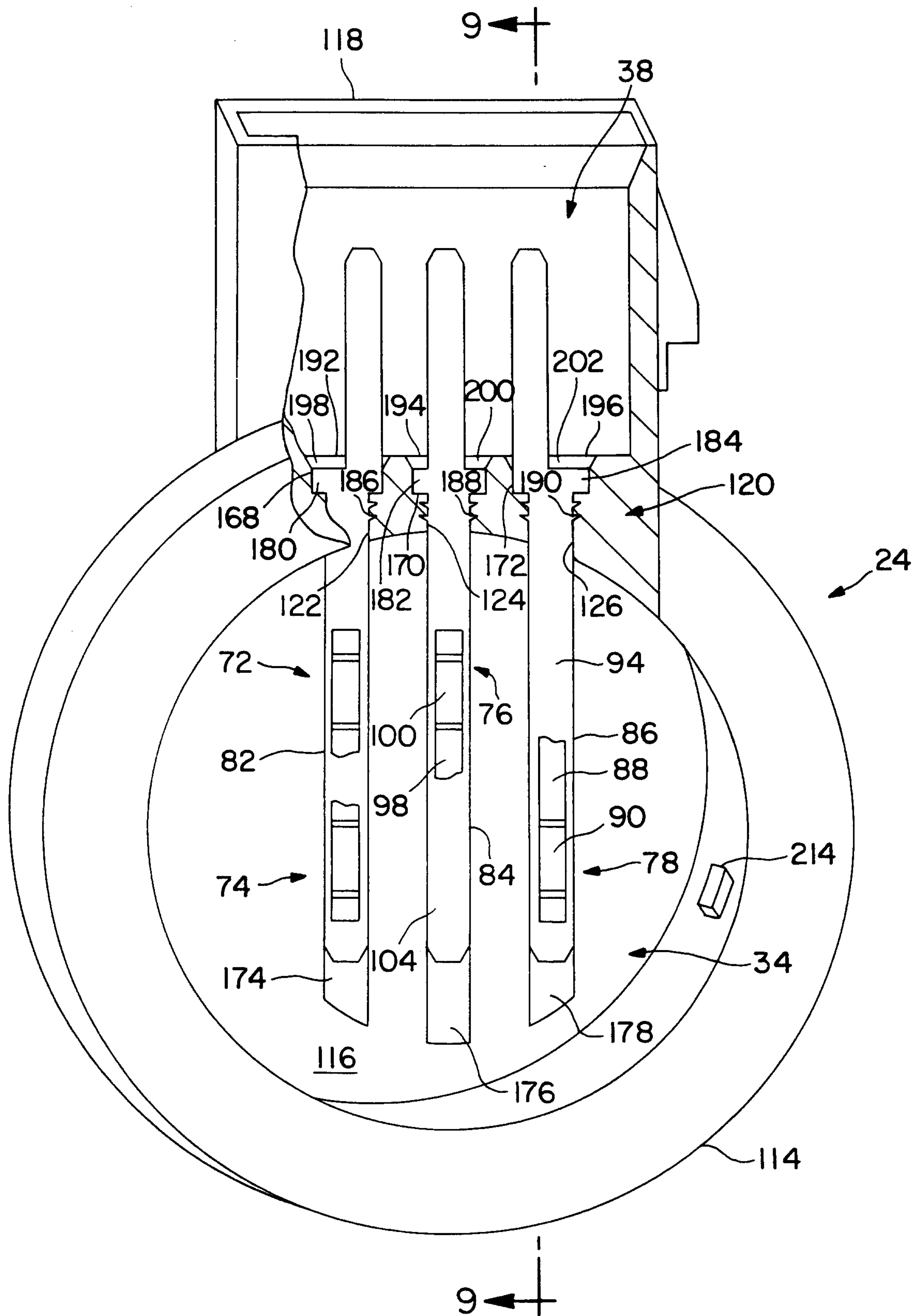


FIG. 5

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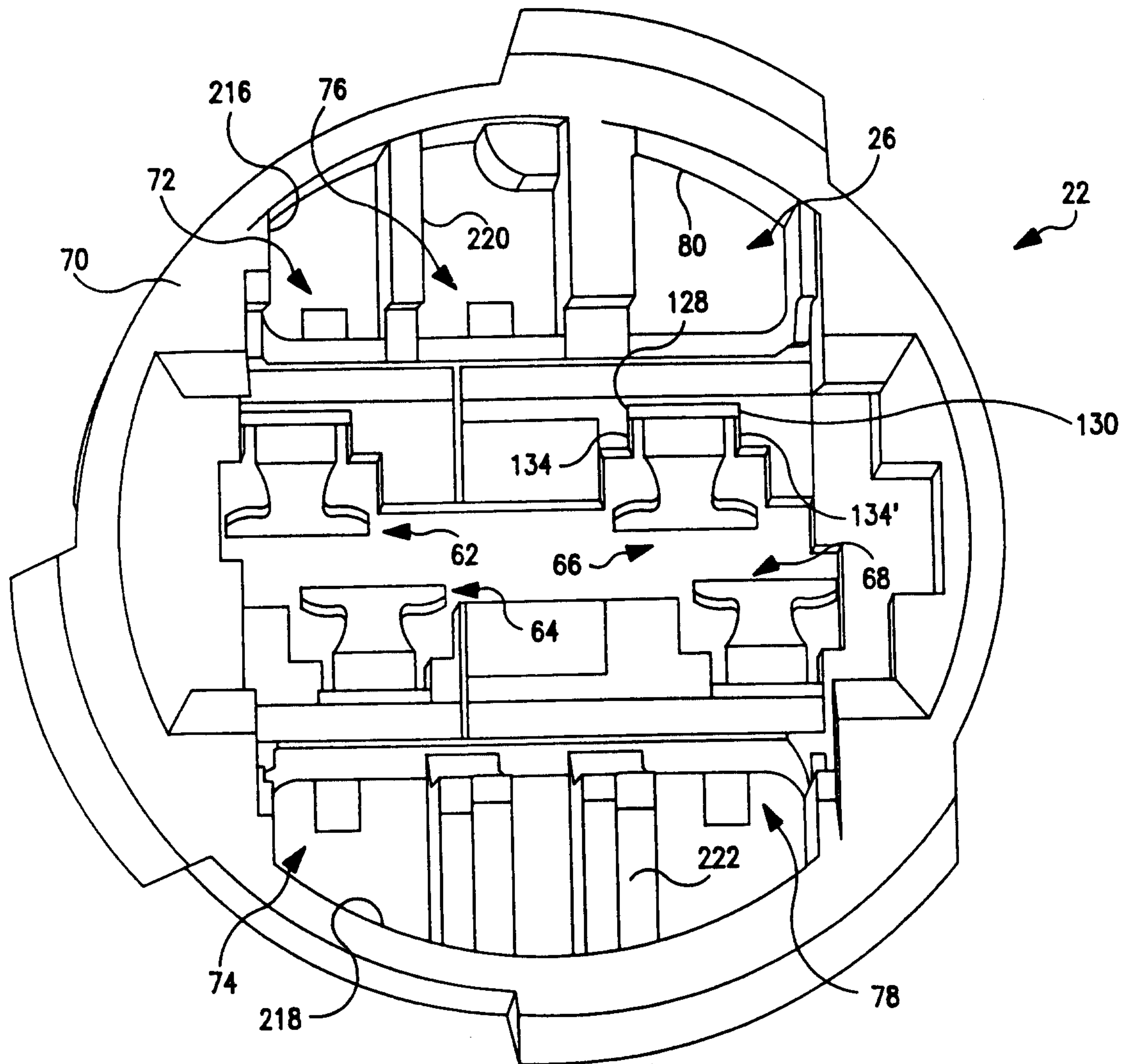


FIG. 6

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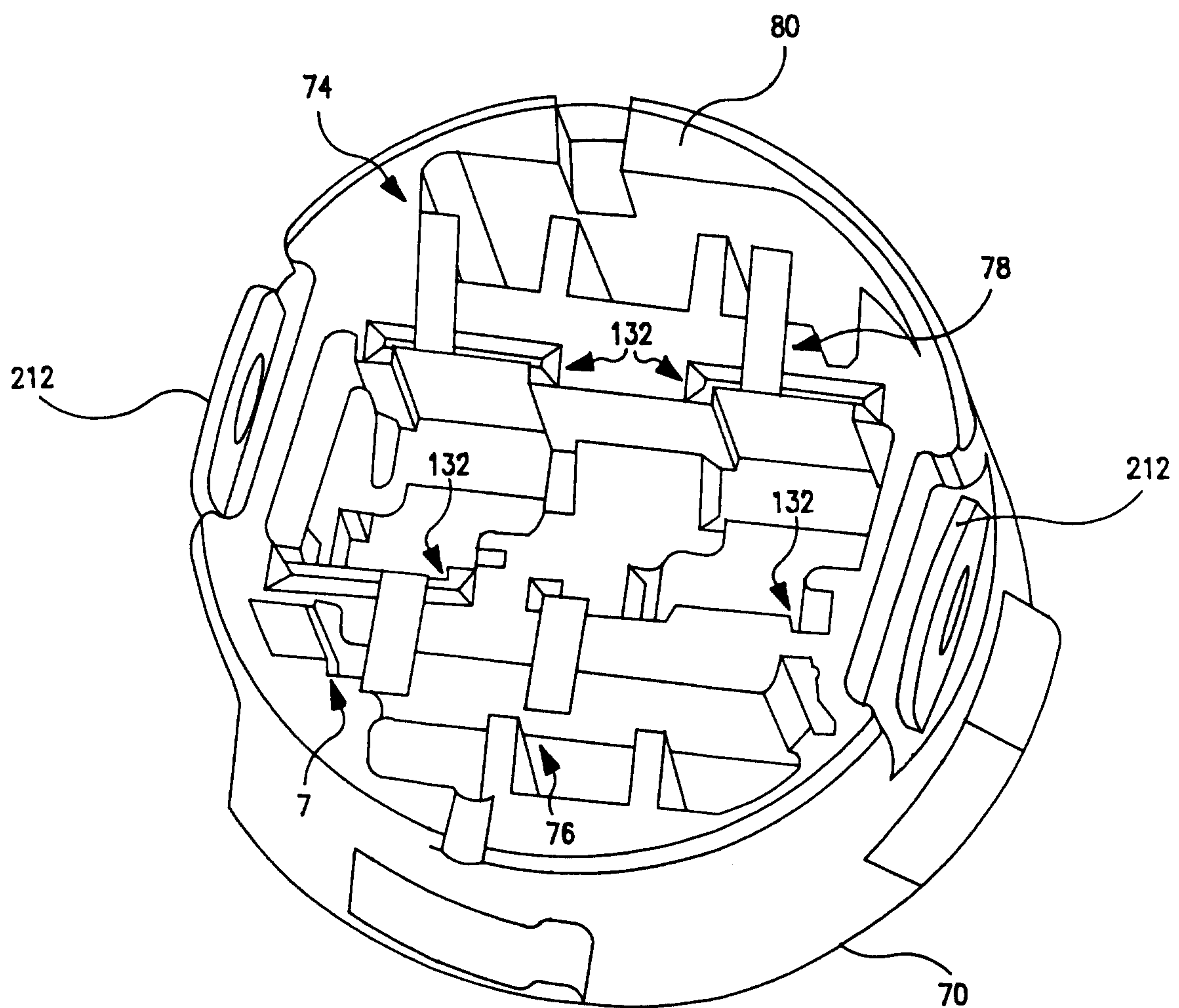


FIG. 7

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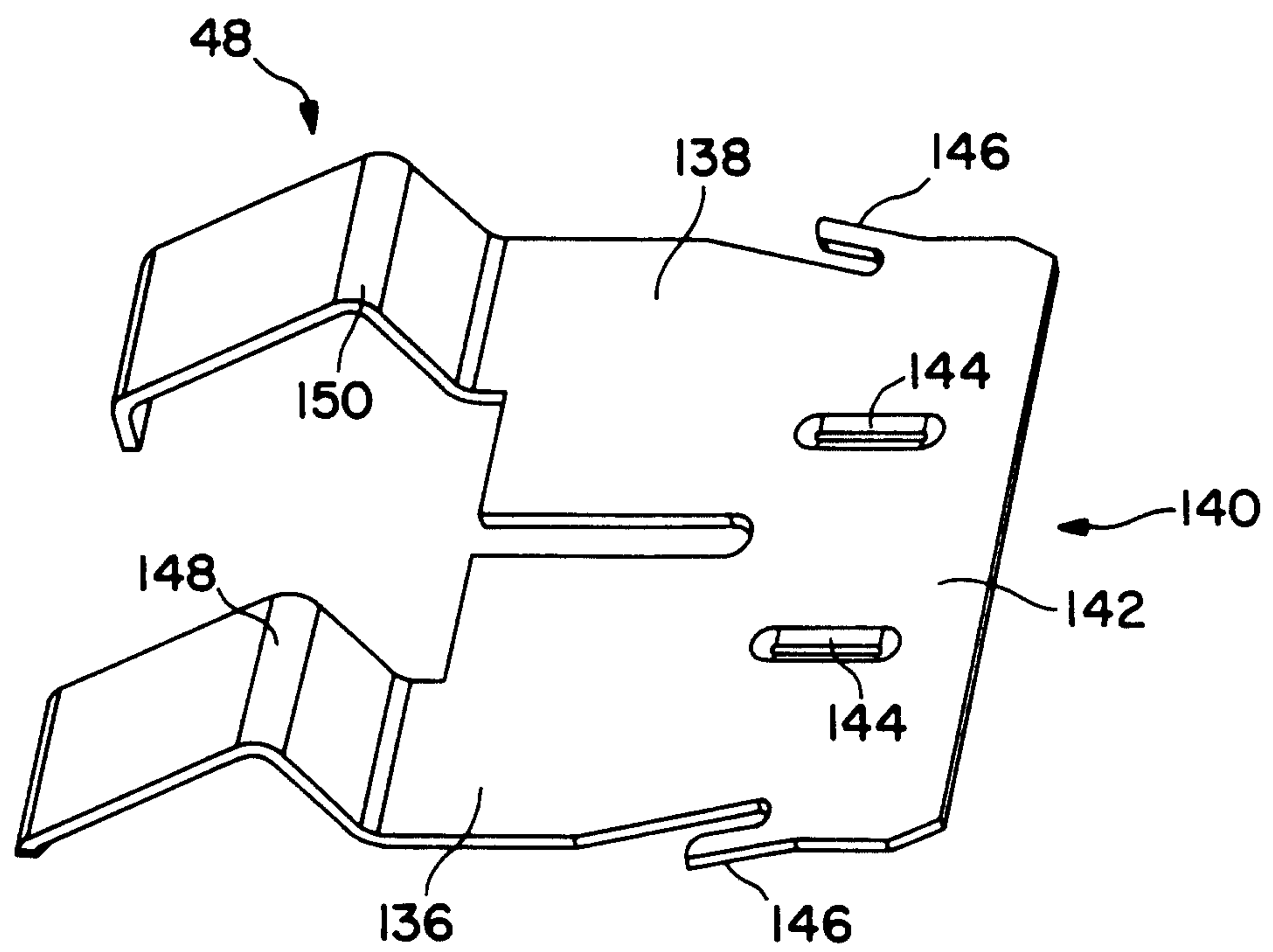


FIG. 8

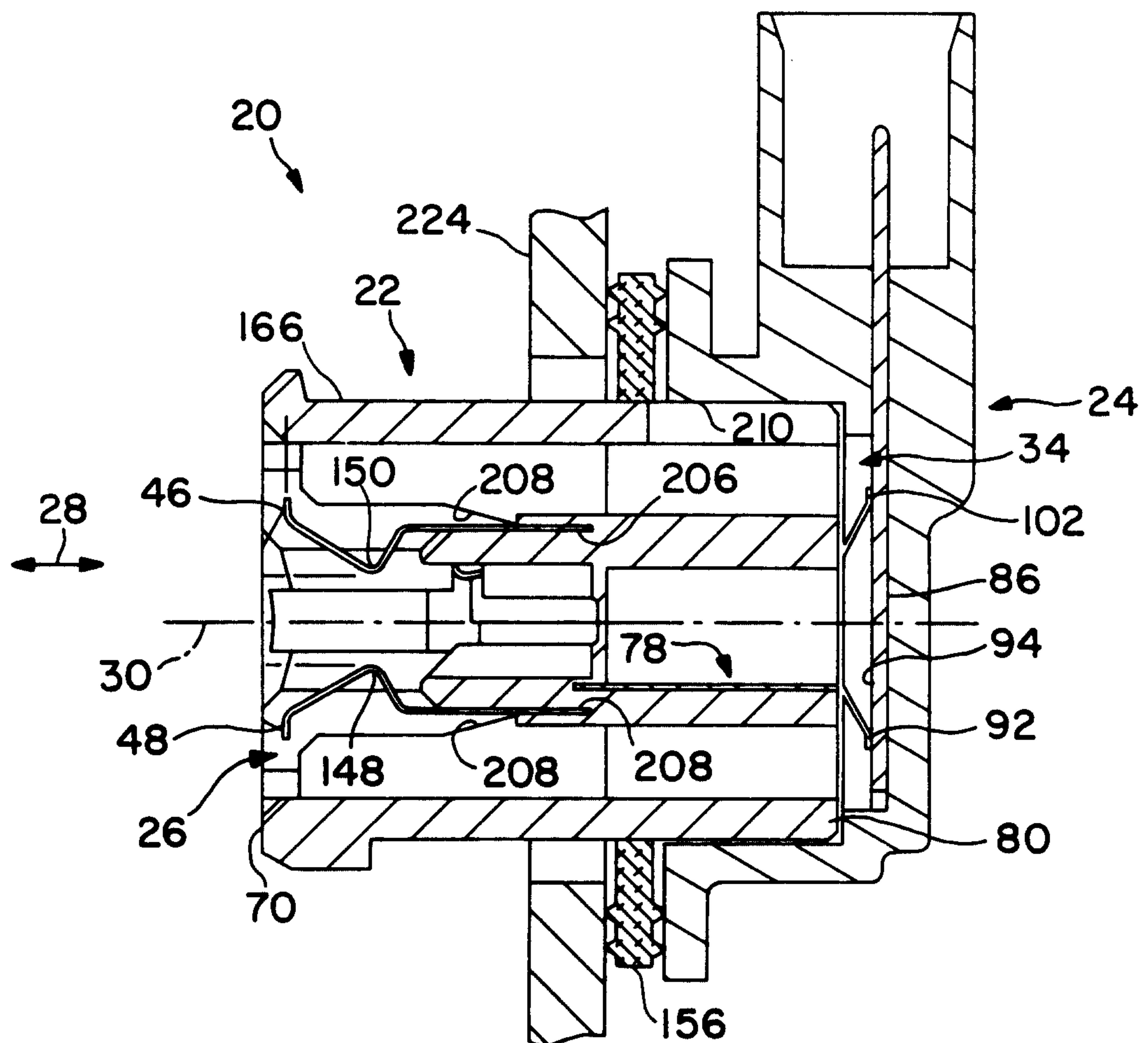


FIG. 9

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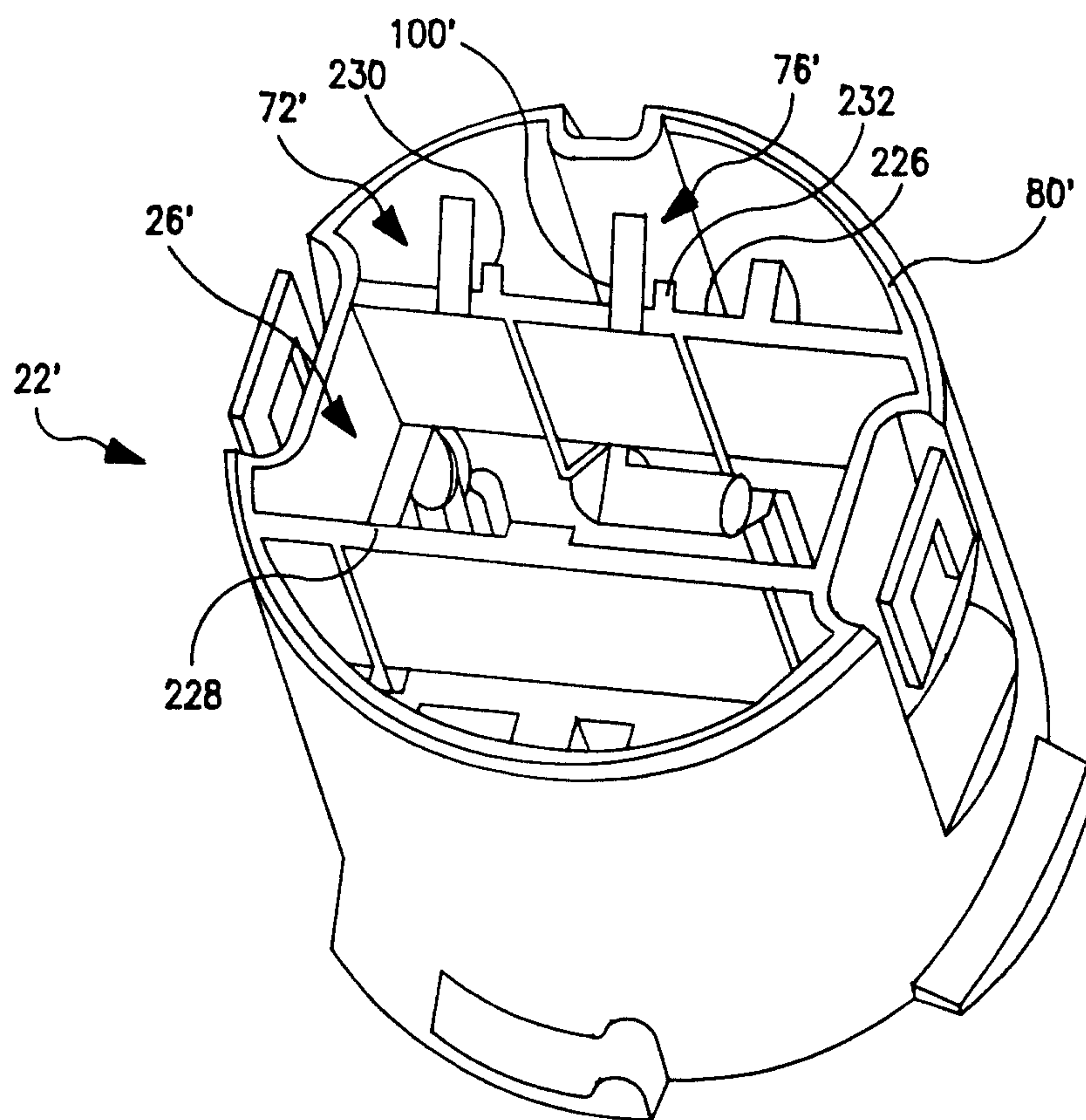


FIG. 10

