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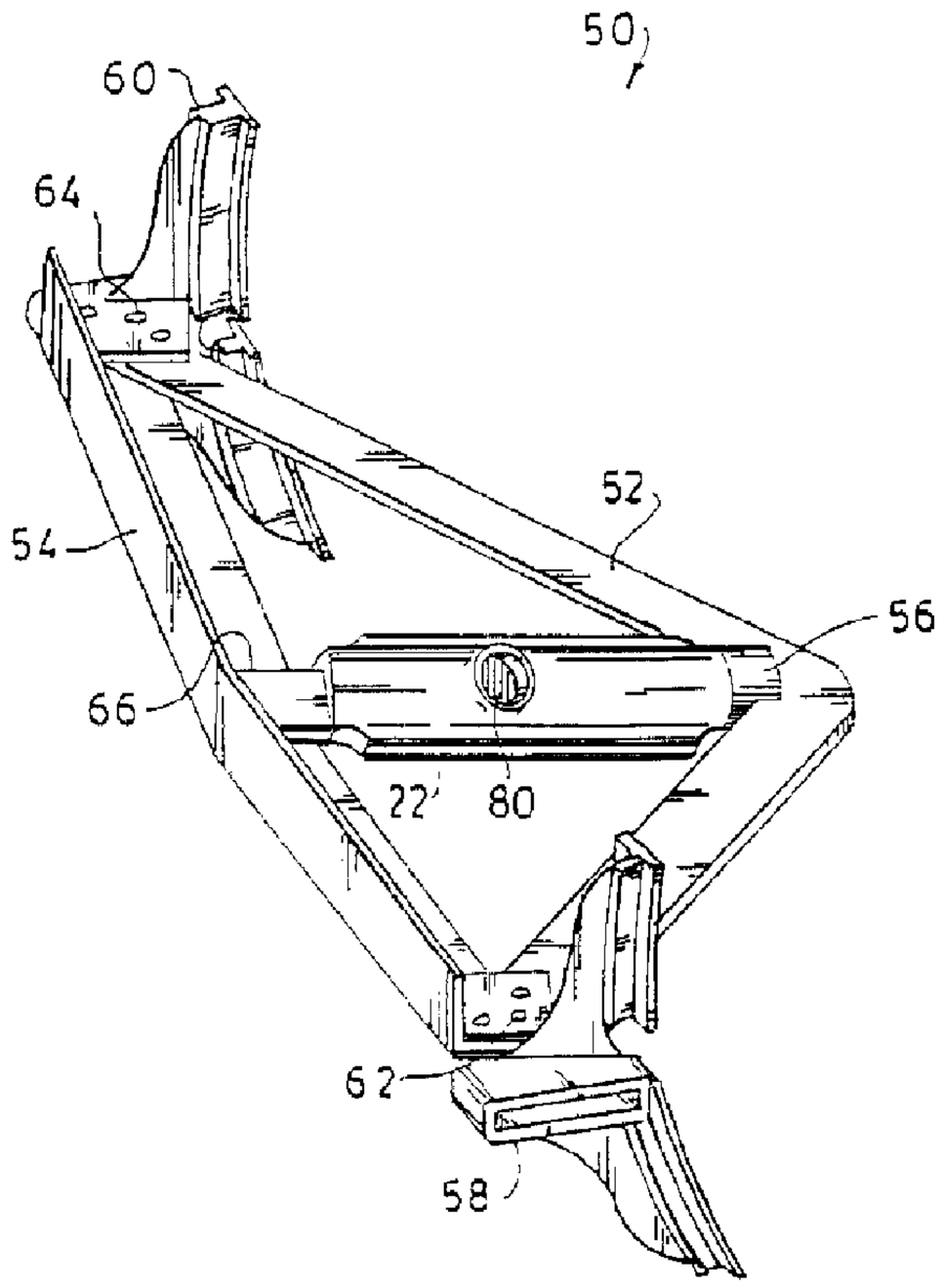


(57) Abrégé/Abstract:
A brake beam assembly comprised of a compression member (54) with a first end and a second end, a tension member (52) with a third end and a fourth end, a strut (22) connected to the tension member and the compression member, a first brake head, and a second brake head. The ends of the compression and tension members each contain at least two holes (62, 63 and 63, 64) in which is disposed a fastener. At least one of the ends of the compression member and the end of said tension member is contiguous with each of the first brake head and the second brake head; and with the exception of the compression member, the tension member, and the fasteners, no structural member is contiguous with the brake heads.

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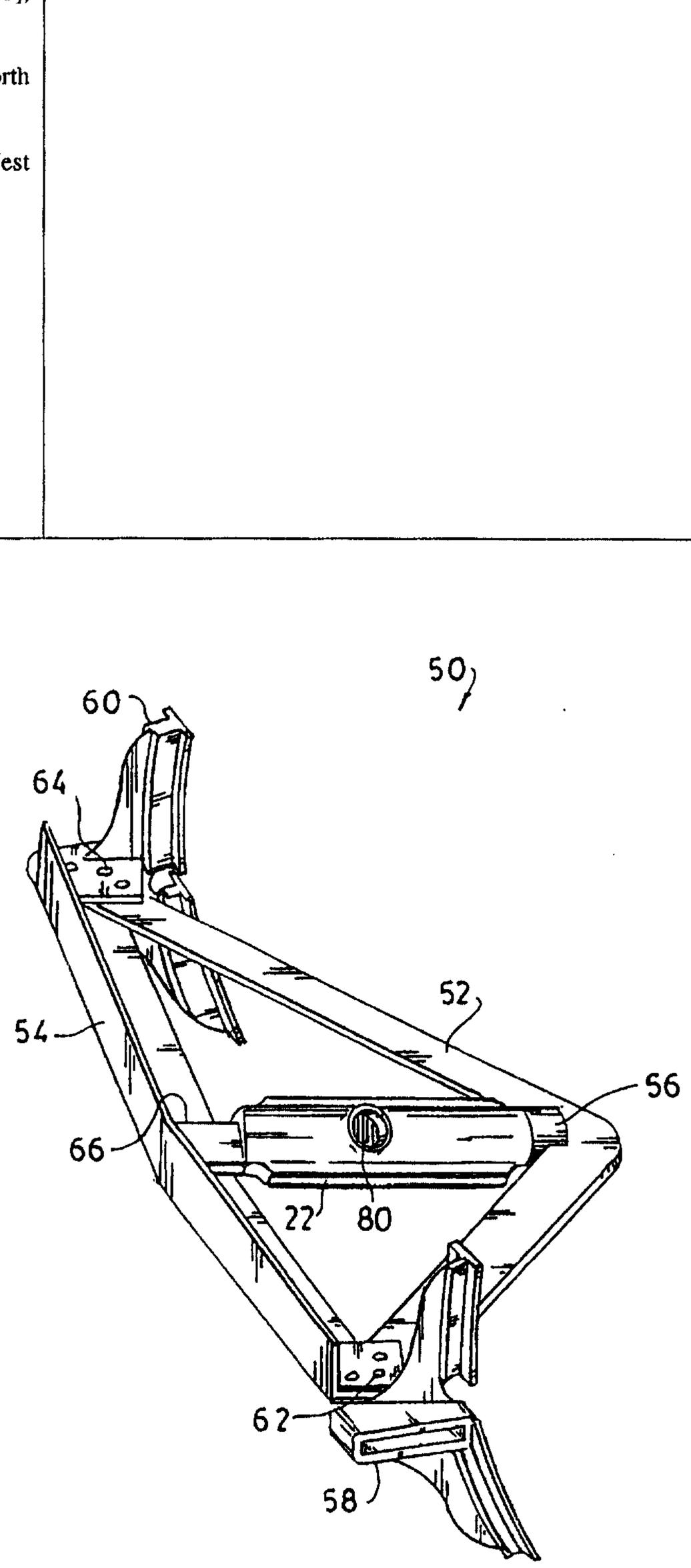
(54) Title: IMPROVED BRAKE BEAM

(57) Abstract

A brake beam assembly comprised of a compression member (54) with a first end and a second end, a tension member (52) with a third end and a fourth end, a strut (22) connected to the tension member and the compression member, a first brake head, and a second brake head. The ends of the compression and tension members each contain at least two holes (62, 63 and 63, 64) in which is disposed a fastener. At least one of the ends of the compression member and the end of said tension member is contiguous with each of the first brake head and the second brake head; and with the exception of the compression member, the tension member, and the fasteners, no structural member is contiguous with the brake heads.



# Description

## Improved Brake Beam

### Technical Field

A brake beam for use on railroad car trucks

### Background Art

Brake beams are well known to those in the art and have been used with railroad car trucks for at least ninety years. One such brake beam is disclosed in United States patent 2,517,747 of L.L. Whitney, which is assigned to American Steel Foundries of Chicago, Illinois. This Whitney patent describes a hanger type brake beam comprising a compression member having top and bottom webs and a front web, a filler block externally of the space between said top and bottom webs, bearing against the forward surface of said front web and having an arcuate opening extending from the inboard to the outboard end of said block, a tension member of uniform cross-section from end to end thereof having an end portion bent approximately parallel to said front web, said portion being snugly fitted in said opening, a brake head having a cavity receiving said block, said portion and said webs, said break head having top and bottom rear walls connected to said top and bottom webs, said block and said portion, said connection extending lengthwise of said front web and being spaced from but extending adjacent to the inboard and outboard ends of the block. The structure of the Whitney patent, in addition to being relatively heavy and cumbersome, provides relatively poor static strength and fatigue strength properties in use.

Another prior art brake beam of hangerless or unit type design is disclosed in United States patent 2,170,121 of C.R. Busch This patent discloses a brake beam, including a channel section forming a compression member having its greatest depth at its middle portion, and which, toward its ends, gradually tapers down, and a tension member having its ends firmly attached to the ends of the compression member, the attached ends of the members all extending beyond the points of location for brake heads to guide the beam on car truck frames. The brake bream device of this Busch patent also is relatively heavy and, per unit weight, provides relatively poor static strength and fatigue resistance properties.

Other United States patents have disclosed various brake beam designs; none of them, however, have provided a unit brake beam with substantially improved static strength and fatigue strength properties per unit weight. Illustrative of these prior art failed designs

are the structures disclosed in United States patents 2,427,548 (integral brake beam with cruciform cross section), 2,499,905 (brake beam with integral truss and brake heads), 2,170,122 (brake beam with built-up compression and tension members), and 2,193,580 (brake bream with broad surface for saddle of brake beam strut).

It is an object of an aspect of this invention to provide a brake beam structure which is relatively light weight but also has relatively high static strength and fatigue resistance properties. It is another object of an aspect of this invention to provide a brake bream structure which is substantially more durable and less likely to self-destruct during use than comparable multi-piece prior art brake beam devices. It is yet another object of an aspect of this invention to provide a brake beam structure which is greatly simplified and substantially easier to manufacture than prior art assemblies.

Disclosure of the invention

In accordance with this invention, there is provided a brake beam assembly comprised of a compression member with a first end and a second end, a tension member with a third end and a fourth end, a strut connected to the tension member and the compression member, a first brake head, and a second brake head. The ends of the compression and tension members each contain at least two holes in which is disposed a fastener. At least one of the ends of the compression member and the end of said tension member is contiguous with each of the first brake head and the second brake head, and with the exception of the compression member, the tension member, and the fasteners, no other structural member is contiguous with the brake heads.

According to one aspect of the invention, there is provided a brake beam assembly comprised of a compression member with a first end and a second end, a tension member with a third end and a fourth end, a strut connected to the tension member and the compression member, a first brake head, and a second brake head, wherein:

(a) the first end and the second end of the compression member and the third end and the fourth end of the tension member are each comprised of a first hole, a second hole, and a third hole extending completely through the end;

(b) disposed within each of the first hole is a first fastener, disposed within each of the second hole is a second fastener, and disposed within each of the third hole is a third fastener; and

(c) at least one of the first end of the compression member and the third end of the tension member is contiguous with the first brake head, and at least one of the second end of the compression member and the fourth end of the tension member is contiguous with the second brake head, and with the exception of the compression member, the tension member, the first fastener, the second fastener, and the third fastener, and no other structural member is contiguous with the first brake head or the second brake head; and

(d) wherein the tension member is comprised of a first parallel wall and a second parallel wall which extend from a middle section to a first end section and a second end section, provided that, when the first parallel wall and the second parallel wall extend past the section towards the first end section and the second end section, they are substantially straight without any bends.

According to another aspect of the invention, there is provided a brake beam assembly comprised of a compression member with a first end and a second end, a tension member with a third end and a fourth end, a strut connected to the tension member and the compression member, a first brake head, and a second brake head, wherein:

(a) the first end and the second end of the compression member and the third end and the fourth end of the tension member are each comprised of a first hole and a second hole extending completely through the end;

(b) disposed within each of the first hole is a first fastener, and disposed within each of the second hole is a second fastener;

(c) at least one of the first end of the compression member and the third end of the tension member is contiguous with the first brake head, and at least one of the second end of the compression member and the fourth end of the tension member is contiguous with the second brake head, and with the exception of the compression member, the tension member, the first fastener and the second fastener, no other structural member is contiguous with the first brake head or the second brake head; and

(d) the tension member is comprised of a first parallel wall and a second parallel which extend from a middle section to a first end section and a second end section, provided that, when the first parallel wall and the second parallel wall extend past the section towards the first end section and the second end section, they are substantially straight without any bends.

Although the preferred embodiment of this invention is illustrated with regard to a hangerless or unit brake beam, the invention is equally applicable to a hanger type brake beam.

Brief description of the drawings

The present invention will be more fully understood by reference to the following detailed description thereof, when read in conjunction with the attached drawings, wherein like reference numerals refer to like elements, and wherein:

Figure 1 is a broken plan view of a car truck 10 within which is disposed a brake beam assembly.

Figure 2 is a first perspective view of one preferred embodiment of the break beam of this invention.

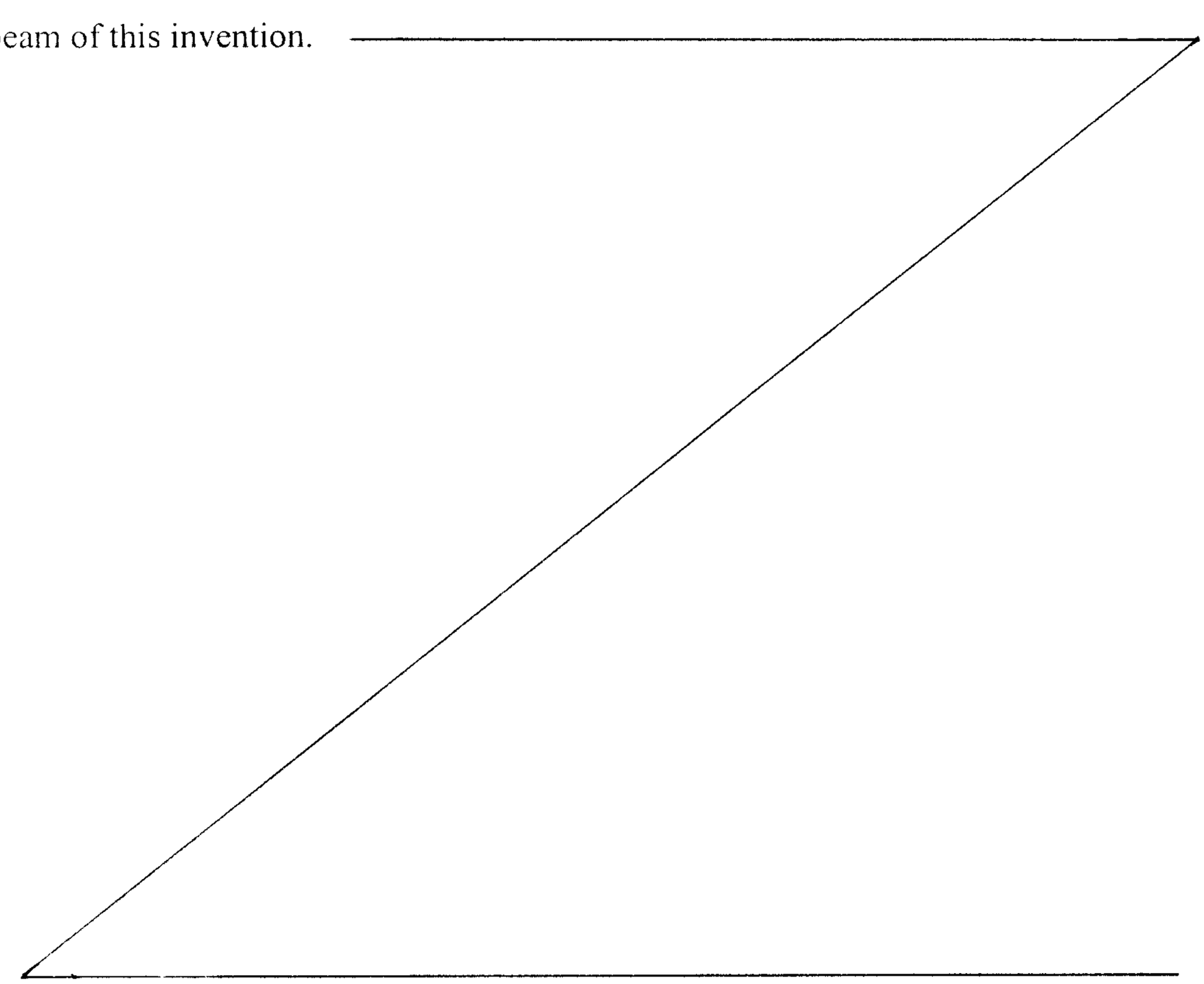


Figure 3 is a second perspective view of the preferred embodiment of Figure 2.

Figure 4 is a plan view of the break beam unit of Figure 2.

Figures 5, 6, and 7 are plan, side, and front views, respectively of tension member 52.

Figures 8, 9, and 10 are plan, front, and side views, respectively, of compression member 54.

Figures 11 and 12 are side and top views, respectively, of brake head 58.

Figures 13, and 14 are perspective views of brake head 58.

Figure 15 is a sectional view of a brake head 58 and its associated brake shoe assembly.

Figures 16A, 16B, and 16C are sectional views of a brake head shoe and key assembly.

Figures 17A and 17B are side and end views, respectively, of a side frame wear plate.

Figure 18 is an end view of another wear plate.

Figure 19 is a plan view of a beam assembly disposed within a truck side frame.

Figure 20 is a perspective view of a brake beam strut.

Figures 21A and 21B are a side view and a sectional view of the brake beam strut of Figure 20.

Figure 22 is a plan view of the brake beam strut of Figure 20 disposed within the tension member.

Figures 23A and 23B are sectional views of the brake beam strut of Figure 20 attached to the compression member.

Figures 24 is a partial sectional view illustrating the brake beam strut of Figure 20 attached to the compression member.

Figures 25A and 25B are side views of a strut bushing assembled into the brake beam strut. Figures 26A, 26B, 26C and 26D, are plan views illustrating the brake beam assembly at various points in its assembly process.

Figure 27 an exploded view of the preferred brake beam assembly hardware, illustrating how it is configured.

Figures 28A, 28B, and 28C are exploded views of preferred brake beam assembly fasteners.

Figures 29A, 29B, and 30 are views of other brake beam assembly fasteners.

Figures 31A. 31B. 31C. 31D, 31E are perspective views of another preferred brake

beam assembly of the invention in which there is no recess.

Best Mode for Carrying Out the Invention

Figure 1 is a broken plan view of a car truck 10. Provided within car truck 10 is brake beam assembly 12, supported on guides 14 and 16 located adjacent to the wheels 18 and 20. A lever (not shown) inserted within slot 22 applies force in the direction of arrows 24 and 26. When force is applied in the direction of arrow 24, the beam 12 moves in the direction arrow 24 so that brake shoes 28 and 30 contact wheels 18 and 20, respectively.

Because of the substantial speeds at which railroad cars travel and the heavy loads they carry, large braking forces are required to be transferred to the wheels through the brake beam assemblies during their operation. These forces, and random vibrations borne through the truck structure to the brake beams, create stresses in areas such as areas 32, 34, 36, 38, 40, 42, 44, and 46.

The railroad industry has expressed concern about the safety record of the United States railroad system. Applicants' brake beam device has been developed in response to such concern.

Figure 2 is a perspective view, taken above and from the back, of the brake beam unit 50 of this invention. Referring to Figure 2, it will be seen that brake beam unit 50 is comprised of a rectiliner tension member 52, a rectilinear compression member 54, strut 56 joining members 52 and 54, brake heads 58 and 60 with recesses (not shown) within which members 52 and 54 partially nest, fasteners 62 and 64 which connect brake heads 58 and 60 to members 52 and 54, and a fastener 66 (not clearly shown in Figure 2) connecting strut 56 to compression member 54.

Figure 3 is another perspective view of brake beam unit 50, taken from below unit 50 and to its front. Fastener 66 is more clearly indicated in Figure 3.

Figure 4 is a plan view of the brake beam unit 50. In this embodiment, the unit has only two fasteners 63 per end, the unit 50 has an overall length 68 of from about 69 to 70 inches, an overall distance 70 to the outside of the brake heads 58 and 60 of from about 63 to 64 inches, a distance 72 between the centerlines of the brake heads 58 and 60 of from about 60 to 61 inches, a distance 74 from the centerline of the beam unit 50 to the centerline of either brake head 58 or 60 of from about 29.5 to about 30.5 inches, a clear distance 76 from the end of beam 50 to either brake head 58 or 60 of from about 2.5 to about 3.5 inches, a distance 78 from the centerline face of brake head 58 (or 60) to the centerline of the strut

pinhole 80 of from about 1 to about 1.5 inches, a length 82 of the strut lever slot 22 of from about 7.5 to about 8.5 inches, a distance 84 from point 86 (at the back of compression member 54) to the centerline of pinhole 80 of from about 7.5 to about 8.5 inches, and a depth 88 from point 86 to the nose 90 of tension member 52 of from about 17 to about 18 inches.

In one embodiment, the dimensions of brake beam unit 50 are in substantial accordance with the Association of American Railroads' "Manual of Standards and Recommended Practices", Section D, Trucks and Truck Details, Standard S-345-79 (Adopted 1875, Revised 1979), "Application Tolerances for Brake Beams, Hangerless Types" (See Figure 12, page D-213).

Tension member 52

Figure 5 is a plan view of tension member 52. Because of its unique geometry and construction, it is especially suited for use in applicants' brake beam 50.

Figure 6 is a side view of tension member 52. It will be seen that, in the preferred embodiments depicted in Figures 5 and 6, tension member 52 has a substantially "flat" cross-sectional shape. Upper surface 92 and lower surface 94 are substantially parallel to each other, thereby producing the desired flat structure 52 which consequently can be within the recess (not shown) in brake head 58 and/or 60. Alternatively, one may use members with other cross-sectional shapes. As long as there is at least one leg with two substantially parallel sides, other structural members may be present in tension member 52.

In one embodiment, not shown, tension member 52 forms an angle of about 90 degrees throughout its length.

It is preferred that tension member 52 have a cross-sectional area of from about 0.5 to about 5.0 square inches and, more preferably, from about 1.0 to about 3.0 square inches. In an even more preferred embodiment, the cross-sectional area of tension member 52 is from about 1.2 to about 2.0 square inches.

The cross-sectional area of tension member 52 is the product of its width 96 and its thickness 98 (see Figure 7).

Referring to Figure 5, width 96 is preferably substantially constant over its entire length; and width 96 preferably is from about 1 to about 4 inches. In a more preferred embodiment, width 96 is from about 2 to about 3 inches.

In addition to having a constant width 96, tension member 52 preferably is comprised of parallel walls 107 and 109, and 111 and 113 which, when they extend past arcuate section

112 on either side, are substantially straight, without any bends.

Walls 107 and 111 are cut to form notched sections 114 and 116. Notched sections 114 and 116 preferably will be substantially contiguous with surfaces 118 and 120 of compression member 54 (see Figure 4).

Thickness 98 is preferably from about 0.25 to about 4 inches. In a more preferred embodiment, thickness 98 is from about 0.35 to about 1.0 inches.

It is preferred that tension member 52 be comprised of or consist essentially of a material such that, with the preferred cross-sectional area, member 52 have a yield strength of from about 20,000 to 100,000 pounds per square inch and, more preferably, from about 30,000 to about 60,000 pounds per square inch. In one embodiment, tension member 52 consists essentially of carbon steel with a carbon content of from about 0.05 to about 0.8 percent.

It is also preferred that tension member 52, with the specified cross-sectional area, have an elongation at break of at least about eight percent and, more preferably, at least about 12 percent.

Referring again to Figure 5, and in the preferred embodiment depicted therein, it will be seen that tension member 52 preferably has an overall length 100 of from about 50 to about 70 inches and, more preferably, from about 60 to about 65 inches. Inasmuch as tension member 52 is preferably symmetrical around its midpoint 102, distance 102 is preferably at one-half of distance 100.

Tension member 52 preferably has a depth 104 (as measured from the deepest portion of internal bend radius 106) of from about 5 to about 17 inches and, more preferably, from about 10 to about 15 inches.

Tension member 52 is comprised of legs 108 and 110 which are integrally connected to each other through arcuate section 112. The angle 114 formed between legs 108 and 110 is preferably greater than about 105 degrees and, more preferably, is from about 110 to about 150 degrees. In one embodiment, angle 114 is from about 120 to about 140 degrees.

Compression member 54

Figure 8 is a plan view of compression member 54. Because of its unique geometry and construction, it is especially suited for use in applicants' brake beam 50.

Referring to Figures 8, 9, and 10 it will be seen that compression member 54 is preferably comprised of legs 126 and 128 (see Figure 10) which extend through substantially

its entire length 130 (see Figure 8).

Legs 126 and 128 for a substantially ninety degree angle between them. This configuration affords substantial column strength to member 54. Means for measuring and calculating the column strength of structural members are well known to those skilled in the art. Reference may be had, e.g., to United States patents 5,419,373, 5,409,470, 5,403,292, 5,322,213, 5,279,442, 5,217,128, and the like.

Different cross-sectional shapes will afford different amounts of column strength per unit weight. A square tubular shape, or a rectangular tubular shape, gives good results. A cruciform shape also gives relatively good results.

In one preferred embodiment, illustrated in Figure 10, the compression member is in the form of a right angle. In the preferred embodiment depicted in Figure 10, leg 126 has thickness 125 of from about 0.1 to about 0.5 inches and, more preferably, from about 0.2 to about 0.4 inches. Leg 126 preferably has a length 127 of from about 0 to 5 inches and, preferably, from about 2 to about 4 inches.

Similarly, leg 128 has a thickness 131 of from about 0.1 to about 1.0 inches and, more preferably, from about 0.2 to about 0.4 inches. Leg 128 has a length 133 of from about 1 to about 5 inches and, more preferably, from about 2 to about 4 inches.

It is preferred that compression member 54 be comprised of or consist essentially of a material such that it have a yield strength of from about 20,000 to 100,000 pounds per square inch and, more preferably, from about 30,000 to about 60,000 pounds per square inch. In one embodiment, compression member 54 consists essentially of carbon steel with a carbon content of from about 0.05 to about 0.8 percent.

It is also preferred that compression member 54 have an elongation at break of at least about eight percent and, more preferably, at least about 12 percent.

Referring to Figure 8, it will be seen that compression member 54 preferably has an overall length 130 of from about 50 to about 70 inches and, more preferably, from about 60 to about 65 inches. Inasmuch as compression member 54 is preferably symmetrical around its midpoint 135, distance 133 is preferably at one-half of distance 130.

Compression member 54 is comprised of end sections 132 and 134 which are partially disposed within a recess (not shown) in each of brake heads 58 and 60(see Figure 2). The end sections 132 and 134 preferably contain flat, substantially parallel surfaces 136,138 and 140,142 which are adapted to fit within such recess (not shown). Each of end sections

132 and 134 will have a length 144 (which may be identical or different) of from about 2 to about 12 inches and, more preferably, from about 6 to about 10 inches.

End compression member 54 is comprised of a first section 146 and a second section 128. The base leg 152 of section 146 is not coplanar with the base 154 leg of section 148; an offset 150 of from about 0 to about 2.0 inches is preferably used. In one preferred embodiment, offset 150 is from about 0.5 to about 1.5 inches. The term "sweep" is often used to describe such an offset.

Figure 8 is a view of compression member 54 taken from its top. Compression member 54 is preferably offset in two different directions which are orthogonal to each other.

Compression member 54 is comprised of upright leg 156 and upright leg 158, which are not coplanar with each other. Leg 158 has an offset (camber) 160 from leg 156 of from about 0 to about 2.0 inches. In one preferred embodiment, the offset/camber 160 is from about 0.5 to about 1.5 inches. Each of sections 146 and 148 are comprised of flat surfaces 164 and 162 which are adapted to be substantially contiguous with notched sections 114 and 116 (see Figure 5). Furthermore, each of sections 146 and 148 are comprised of end walls 168 and 166 which are adapted to be substantially contiguous with corresponding surfaces (not shown) of brake heads 58 and 60.

Inside surface 162 is substantially coplanar with inside surface 161 of leg 158. Similarly, inside surface 164 is substantially coplanar with inside surface 163 of leg 156. As will be apparent to those skilled in the art, because of the pitch on compression member 54, the 1:20 face angle required for brake heads 58 and 60 may be obtained without additional structural modifications.

At about its midpoint 135, base legs 152 and 154 are joined (see Figure 9), and at this juncture this is a substantially coplanar section 170 extends from about point 172 to about 174 and is preferably from about 2 to 4 inches in length.

Brake Head 58

Figures 11 and 12 are side and top views, respectively, of brake head 58 which is preferably substantially identical to brake head 60.

The brake head 58 illustrated in Figures 11 and 12 is configured in substantial accordance with the aforementioned Association of American Railroad's "TRUCKS AND TRUCK DETAILS" publication. In particular, these embodiments are in substantial accordance with pages Standard S-371-81, "LIMITING CONTOUR OF BRAKE HEADS

FOR HANGERLESS TYPE BRAKE BEAMS", which appears on page D-250 of such publication. Referring to Figures 11 and 12, it will be seen that brake head 58 (and brake head 60) is comprised of a recess defined by flat, parallel, inner surfaces 176 and 178.

Tension member 52 is comprised of linear surface 113 which, in part, abuts a portion of arcuate surface 180. Because of the curved nature of surface 180, varying the length of distance 72 of assembly 50 while keeping distance 88 constant (see Figure 4) will allow surface 180 to compensate for such variation and to maintain substantially broad contact between it linear surface 113.

Surface 180 is also comprised of arc 182 which, when the assembly 50 under loaded conditions deflects, compensates for such deflection.

Referring to Figures 11 and 12 (and also to Figure 13), it will be seen that brake head 58 is comprised of inner surface 184 which is adapted to receive surface 168 of compression member 54.

Brake head 60 is comprised of a split flange 186; this split flange is illustrated in by dotted lines in Figure 14.

It will be seen from Figure 12, e.g., that fasteners 62 which secure tension member 52 to brake head 60 are not colinear. Three fasteners 62 are used in this assembly, although four or more fasteners also may be used.

Without wishing to be bound to any particular theory, applicants believe that, under load, area 190 of compression member 54 makes contact with the underside of area 192 of tension member 52. Because of the nesting arrangement of members 52 and 54, this movement is limited.

Figure 13 is a perspective view of brake head 60, illustrating arc surface 182 tapering away from the tension member (not shown), and also showing surface 184, which contacts the end of the compression member (not shown).

Figure 14 is perspective view of brake head 60, showing, in dotted line outline, split flange 186 and an extension 188. It will be seen that a key guide 194 provides a raised passageway for a brake key (not shown in Figure 14). Key latch 196 is adapted to retain the key (not shown) within the key guide.

Figure 15 is an exploded sectional view illustrating the key assembly. A key 198 is disposed within keyway tunnel 200. Within keyway tunnel 200 is a raised surface, key guide 194, which causes the end 202 of key 198 to be shifted upwardly so that it can enter the slot

204 in brake shoe lug 206. If key guide 194 were not provided, key 198 would be allowed to pass behind the tip 208 of brake shoe lug 206 and, thus, would not engage brake shoe 28 via slot 204.

Figure 16C illustrates a key 198 fully installed in a key assembly; Figures 16B and 16C illustrate the key 198 partially removed from the key assembly.

Figure 16A illustrates one embodiment of a brake key assembly in which key 198 has a region 210 comprised of multiple pleats which are adapted to engage the bottom inside tip 212 of the keyway tunnel 200. These pleats are provided in substantial accordance with the Association of American Railroads "Brake Shoe Keys Standard" S-376 (see page D256).

Figures 16B and 16C illustrate a modified keyway tunnel 200 comprised of a raised section 196 (key latch 196) which is adapted to interlock with pleated section 210. The provision of key latch 196 provides a safety factor for retaining the key 198 within the keyway; and it also deters the complete removal of such key 198.

When key 198 is in its fully installed position, it is not contiguous with key latch 196, and its service life is thus not appreciably affected by such key latch 196. Only when key 198 is partially removed (see Figures 16A and 16B) does it contact the key latch 196, which inhibits its complete removal.

Figures 17A and 17B, and 17C are plan and end views, respectively, of truck side frame wear plate 214, which preferably consists essentially of either steel or plastic. In the preferred embodiment depicted, it is preferred that each of ears 216 have a thickness 218 which is less than about 0.19 inches and, more preferably, less than about 0.16 inches.

In one embodiment, side frame wear plate 214 consists essentially of polyurethane.

Figure 18 shows another embodiment of a truck side frame wear plate 215 in which lips 216 are omitted. Wear plate 215 is comprised of openings 220 (shown in dotted line outline) which are adapted to facilitate the removal of the wear plate 15.

Figure 19 is a plan view of the brake beam 50 connected to side frame 10. There is a gap 224 between the tip 222 of the brake beam end extension and the inside bottom surface 226. There is also a gap 228 between the outside surface 230 of the brake head 60 and the outer surface 232 of the wear plate liner 214. Gap 228 is greater than gap 224. It is preferred that gap 228 be greater than gap 224 by at least about 0.03 inches and, more preferably, by at least about 0.06 inches. This end is achieved by either reducing the thickness 218 and/or removing lip 216; and this result reduces the possibility of brake beam

binding.

Figure 20 is a perspective view of strut 56 which is preferably comprised of slots 234, 236, 238, and 240, which are adapted to engage the tension member 52 (see Figure 2). Strut 56 is comprised of tail support 242 comprising legs 244 and 246 which are adapted to engage compression member 54 (see Figure 2). Strut pin hole 80 is adapted to receive a bushing.

Figures 21A and 21B are side and sectional views, respectively of strut 56. The strut 56 is comprised of a tube-shaped steel assembly 248.

Figure 22 is a plan view of strut 56 engaging tension member 52. The perimeter 250 of strut 56 intersects tension member 52 at tangent points 252 and 254, thus providing a substantial amount of stability and self-centering. It is preferred that the diameter of strut 56 be at least from about 2 to about 5 inches.

Contact surfaces 256, 258, 260, and 262 help provide such stability. Contact surfaces 256 and 258 each have a pitch which is smaller than the pitch of contact surfaces 260 and 262, thereby insuring contact at points 252 and 254. As the assembly is loaded, contact will be made at the desired contact surfaces 256, 258, 260, and 262.

The fact that contact occurs at at least two locations (256 and 258) rather than at only a single location reduces the potential fatigue failure at any one point.

Slots 234 and 238 provide substantial interlock between strut 56 and tension member 52. Reference also may be had to Figure 2, which shows such interlock.

Figures 23A and 23B are sectional end views of strut 56, illustrating the relative positions of slot pairs 234/238 and 236/240 and legs 244 and 246.

Figure 24 is a partial sectional view illustrating the connection between tension member 54 and strut 56 with fastener 66. Fastener 66 is loaded in shear, thereby providing a simplified assembly.

Figures 25A and 25B are partial side views of strut 56. Strut 56 is adapted to receive either bushing 264 and bushing 266. The outside diameter of both of these bushings is identical, but the inside diameters are varied. Thus, with the use of one strut 56 with only one strut pinhole 80, bushings with different inside diameters can be used. .

Figure 26A is a tension member 52 prior to the time any other components have been attached to it. In the assembly step illustrated in Figure 26B, tension member 52 is inserted into brake heads 58 and 60 which are located at controlled positions 268 and 270.

In the assembly step illustrated in Figure 26C, a subassembly 274 is constructed by

joining strut 56 to compression member 54 by means of fastener 66.

In the assembly step illustrated in Figure 26D, subassembllies 272 and 274 are joined by inserting subassembly 274 into subassembly 272, thereby producing new subassembly 276. Thereafter, at points 278 and 280, forces are sequentially applied by means of clamps (or other suitable means) to cause contact between surface 168 at the end of compression member 54, and surface 184 on brake head 60 (see Figure 12). As will be apparent to those skilled in the art, because of the symmetry of the beam, a similar effect occurs at the interface between brake head 58, and the compression member 54. Subsequently, and similarly, forces are then applied at points 282 and 284 to compress the ends of bar 52 between compression member 54 and brake heads 58 and 60.

The compressed structure thus produced is identified as subassembly 276. Thereafter, holes 286 and 288 are drilled in the assembly to receive fasteners (not shown).

Figure 27 is a partial exploded view of subassembly 276. Fasteners 66 are preferably inserted through holes 286 and 288 and secured with fasteners collars 290.

In the preferred process illustrated in Figure 27, lower and upper mandrels 292 and 294 are used to force collars 290 onto the fasteners 66 and to swage them into final fastening position. It will be noted that lower mandrel 292 preferably contains preloading springs 296 and 298 adapted to clamp the beam assembly 276 prior to swaging collars 290.

Figures 28A, 28B, and 28C illustrates a two piece rivet 300 which can be used which is comprised of a pin 302 and a collar 304. Figures 29A and 29B illustrate an bolt 308/nut 310 fastener. Figure 30 illustrates a solid integral rivet 312 which also may be used. A welded joint (not shown) also may be used.

Figures 31A, 31B, 31C, 31D, and 31E are perspective views of another preferred embodiment of the brake beam of the invention in which there are no recesses. Brake beam assembly 330 is similar to the brake beam assembly 50 depicted in Figure 3 but does not contain the recess and the lower flange depicted in such Figure.

Figure 31B is a side elevational view of brake beam assembly 330 illustrating the absence of such lower flange and recess.

Figure 31C is a side elevational view of a brake beam assembly 340 in which the arrangement of the tension member 52 and the compression member 54 is reversed from their position in Figure 31B.

Figure 31D is also a side elevational view of a brake beam assembly 350 in which the

arrangement of the tension member 52 and the compression member 54 differs from the arrangements utilized in Figures 31A, 31B, and 31C.

Figure 31E is also a side elevational view of a brake beam assembly 360 in which the arrangement of the tension member 52 and the compression member 54, and the means for fastening these members to the brake head, differs from that depicted in Figures 31A, 31B, 31C, and 31D.

It is to be understood that the aforementioned description is illustrative only and that changes can be made in the apparatus, in the ingredients and their proportions, and in the sequence of combinations and process steps, as well as in other aspects of the invention discussed herein, without departing from the scope of the invention as defined in the following claims.

WHAT IS CLAIMED IS:

1. A brake beam assembly comprised of a compression member with a first end and a second end, a tension member with a third end and a fourth end, a strut connected to said tension member and said compression member, a first brake head, and a second brake head, wherein:

(a) said first end and said second end of said compression member and said third end and said fourth end of said tension member are each comprised of a first hole, a second hole, and a third hole extending completely through said end;

(b) disposed within each of said first hole is a first fastener, disposed within each of said second hole is a second fastener, and disposed within each of said third hole is a third fastener; and

(c) at least one of said first end of said compression member and said third end of said tension member is contiguous with said first brake head, and at least one of said second end of said compression member and said fourth end of said tension member is contiguous with said second brake head, and with the exception of said compression member, said tension member, said first fastener, said second fastener, and said third fastener, and no other structural member is contiguous with said first brake head or said second brake head; and

(d) wherein said tension member is comprised of a first parallel wall and a second parallel wall which extend from a middle section to a first end section and a second end section, provided that, when said first parallel wall and said second parallel wall extend past said section towards said first end section and said second end section, they are substantially straight without any bends.

2. The brake beam assembly as recited in claim 1, wherein said third hole is not colinear with said second hole and said first hole.

3. The brake beam assembly as recited in claim 1, wherein said tension member has an upper surface and a lower surface which are substantially parallel to each

other.

4. The brake beam assembly as recited in claim 1, wherein said tension member has a cross-sectional area of from about 0.5 to about 5.0 square inches.

5. The brake bream assembly as recited in claim 1, wherein said tension member has a cross-sectional area of from about 1.2 to about 2.0 square inches.

6. The brake beam assembly as recited in claim 1, wherein said tension member has a first notched section and a second notched section.

7. The brake beam assembly as recited in claim 6 wherein each of said first notched member and said second notched member is substantially contiguous with said compression member.

8. A brake beam assembly comprised of a compression member with a first end and a second end, a tension member with a third end and a fourth end, a strut connected to said tension member and said compression member, a first brake head, and a second brake head, wherein:

(a) said first end and said second end of said compression member and said third end and said fourth end of said tension member are each comprised of a first hole and a second hole extending completely through said end;

(b) disposed within each of said first hole is a first fastener, and disposed within each of said second hole is a second fastener;

(c) at least one of said first end of said compression member and said third end of said tension member is contiguous with said first brake head, and at least one of said second end of said compression member and said fourth end of said tension member is contiguous with said second brake head, and with the exception of said compression member, said tension member, said first fastener and said second fastener, no other structural member is contiguous with said first brake head or said second brake head; and

(d) said tension member is comprised of a first parallel wall and a second

parallel which extend from a middle section to a first end section and a second end section, provided that, when said first parallel wall and said second parallel wall extend past said section towards said first end section and said second end section, they are substantially straight without any bends.

9. The brake beam assembly as recited in claim 8, wherein said tension member has an upper surface and a lower surface which are substantially parallel to each other.

10. The brake beam assembly as recited in claim 8, wherein said tension member has a cross-sectional area of from about *0.5* to about *5.0* square inches.

11. The brake bream assembly as recited in claim 8, wherein said tension member has a cross-sectional area of from about 1.2 to about 2.0 square inches.

12. The brake beam assembly as recited in claim 8, wherein said tension member has a first notched section and a second notched section.

13. The brake beam assembly as recited in claim 12, wherein each of said first notched member and said second notched member is substantially contiguous with said compression member.

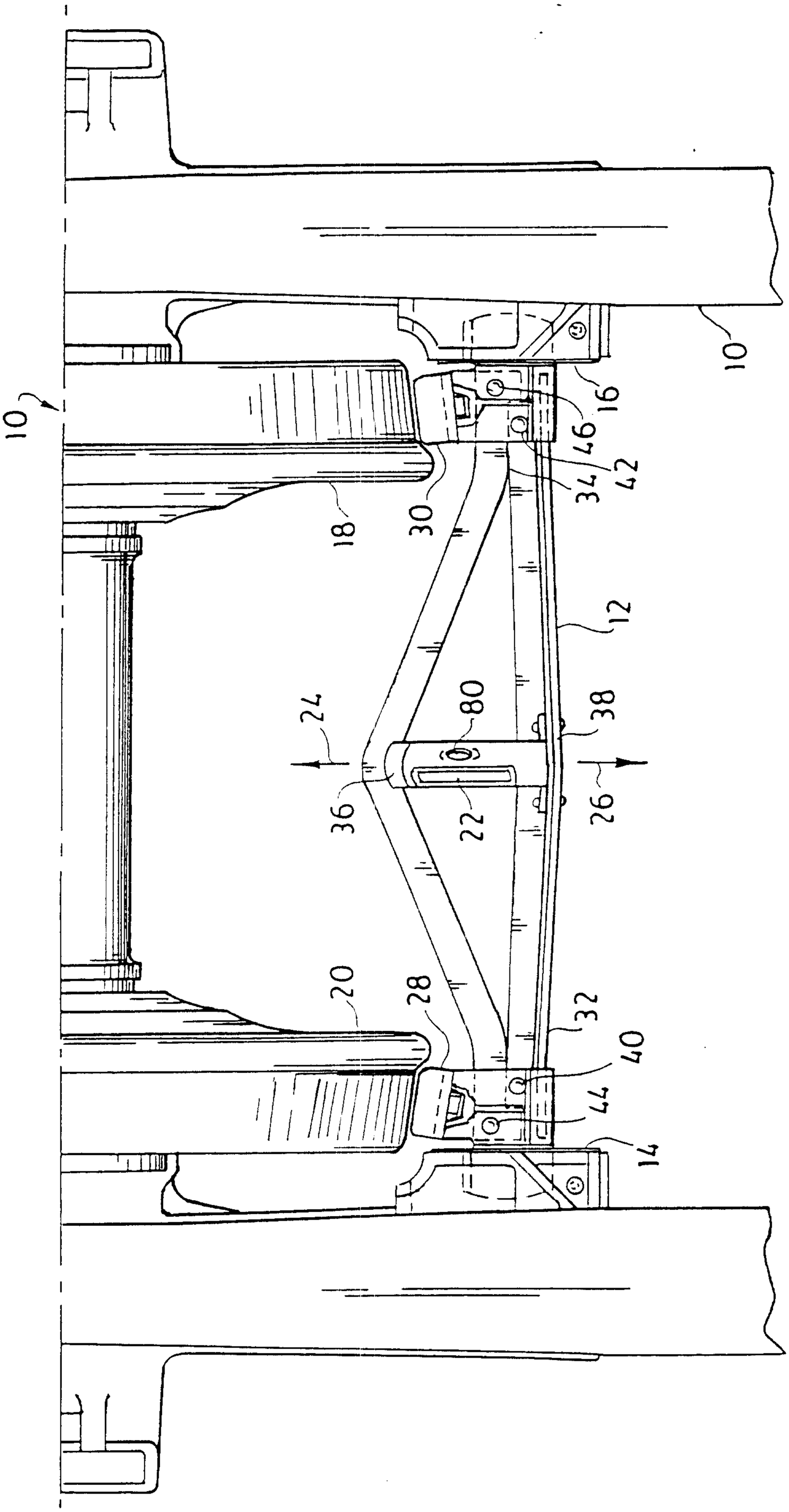



FIG.1

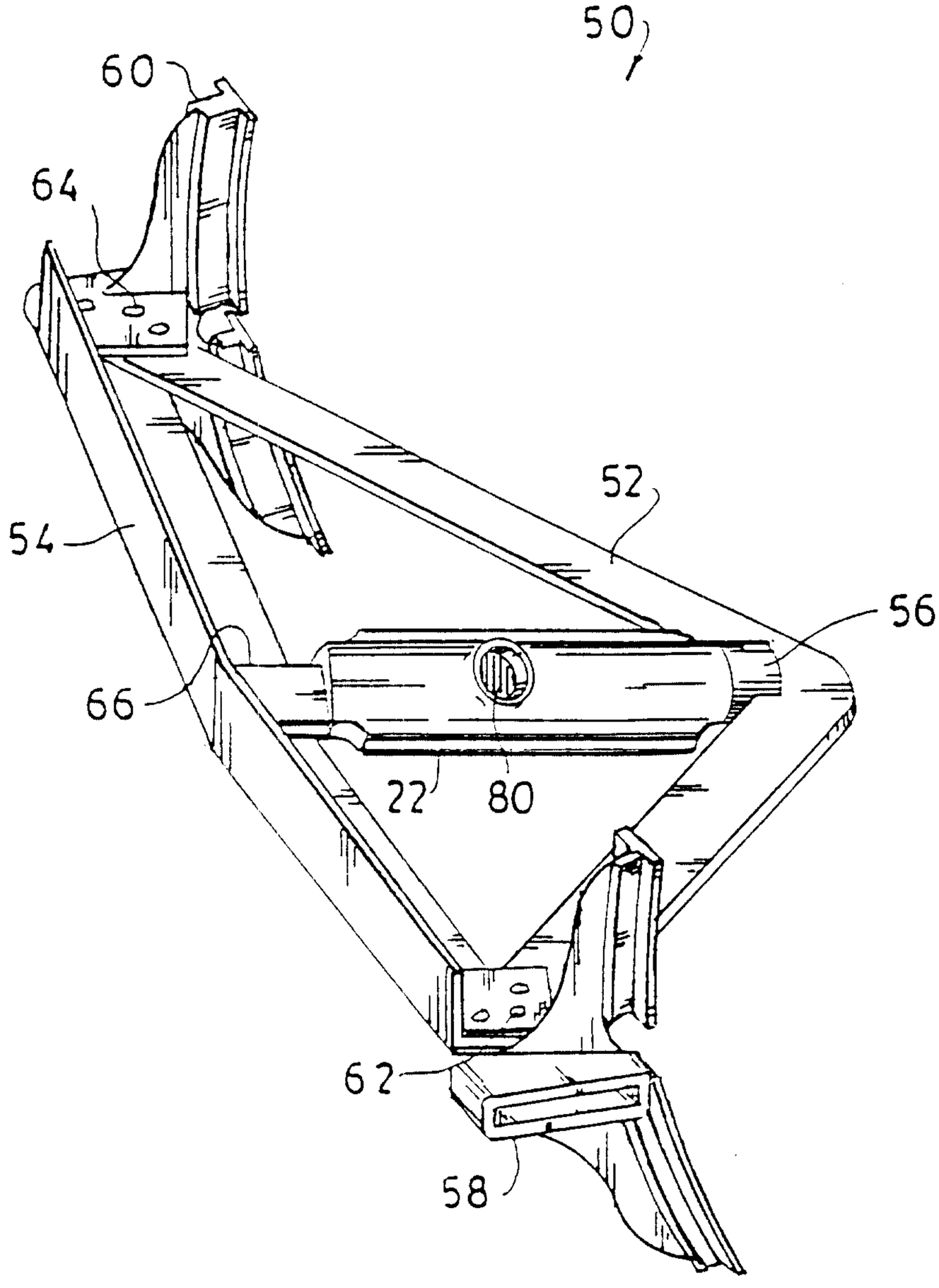



FIG. 2

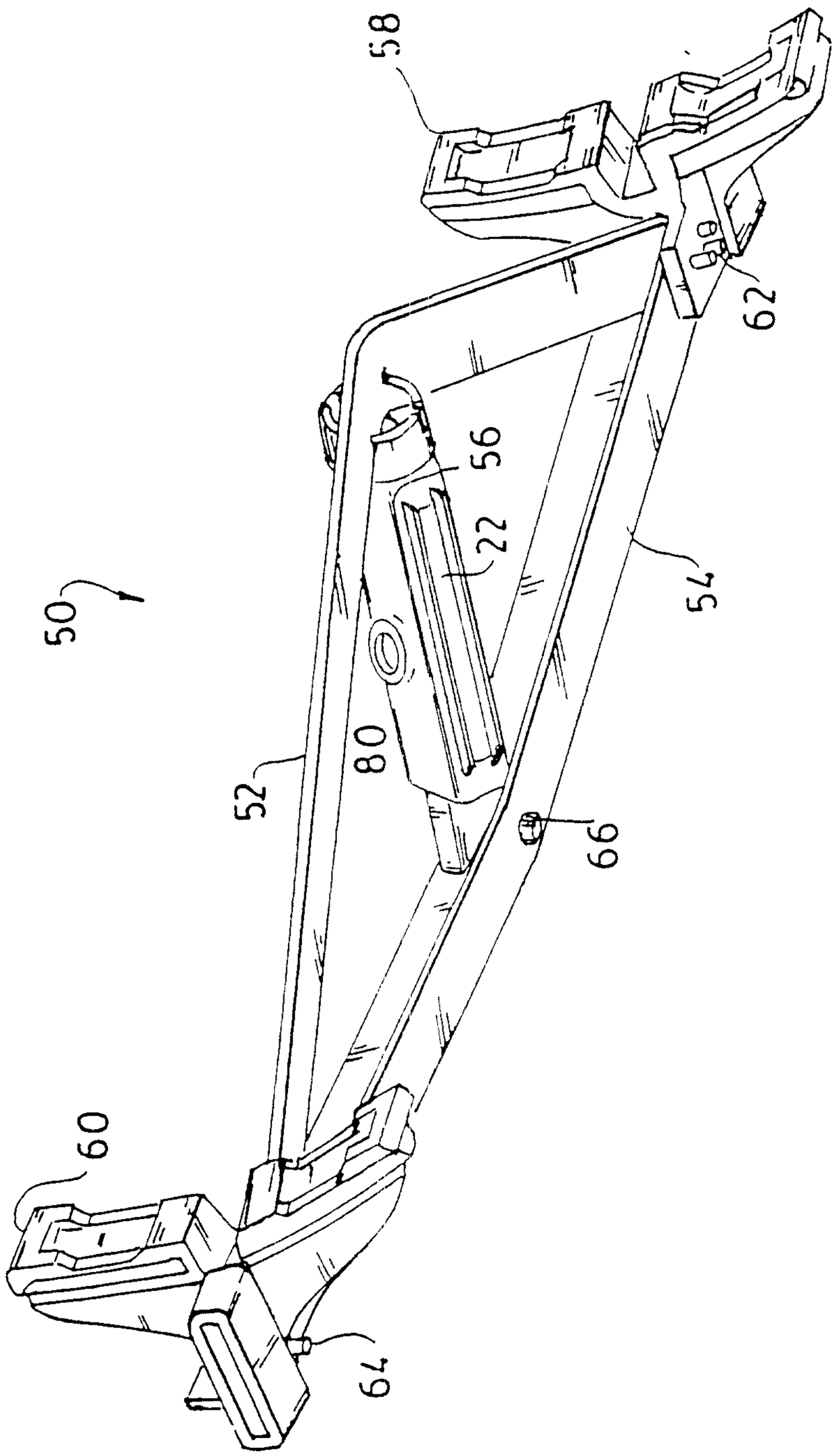



FIG. 3

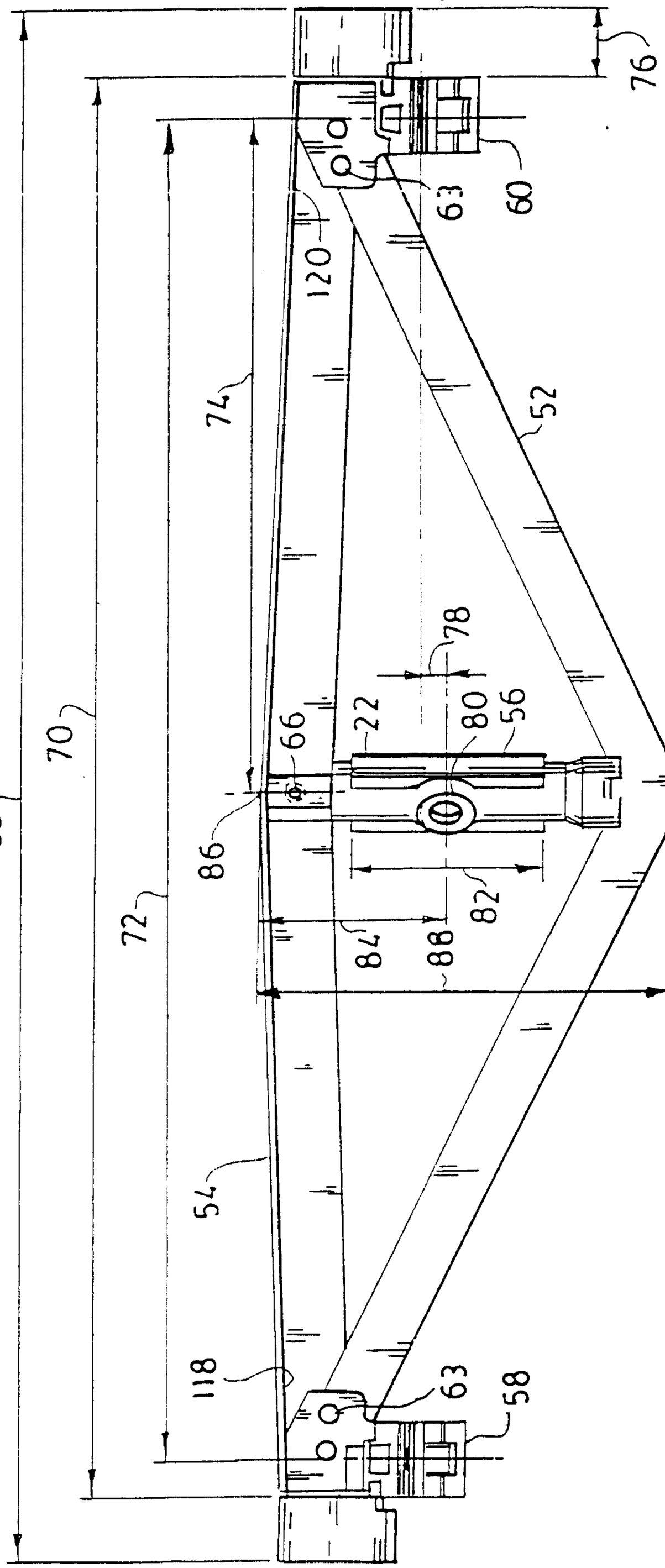

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FIG.4

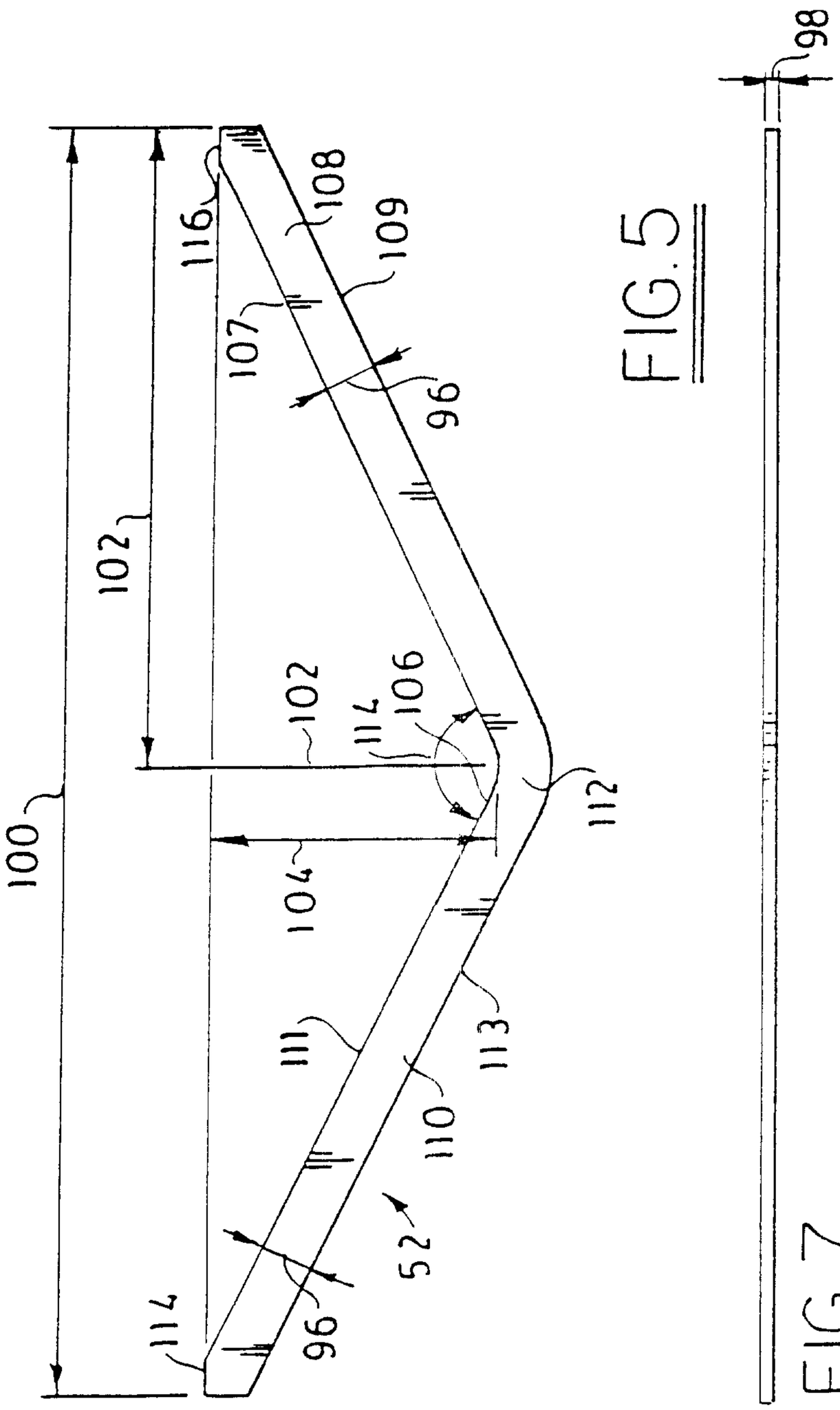



FIG.5

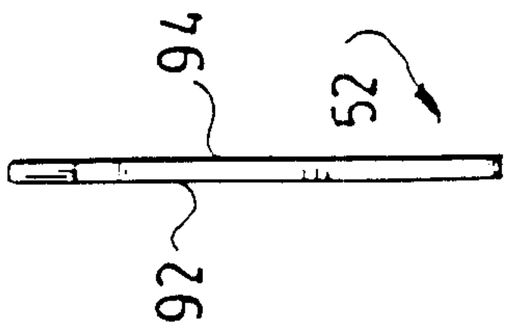



FIG.6

FIG.7

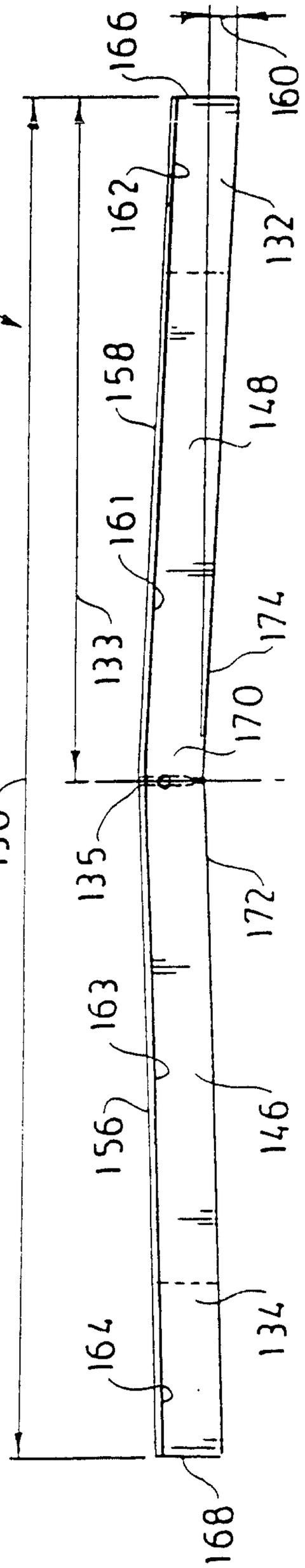



FIG. 8

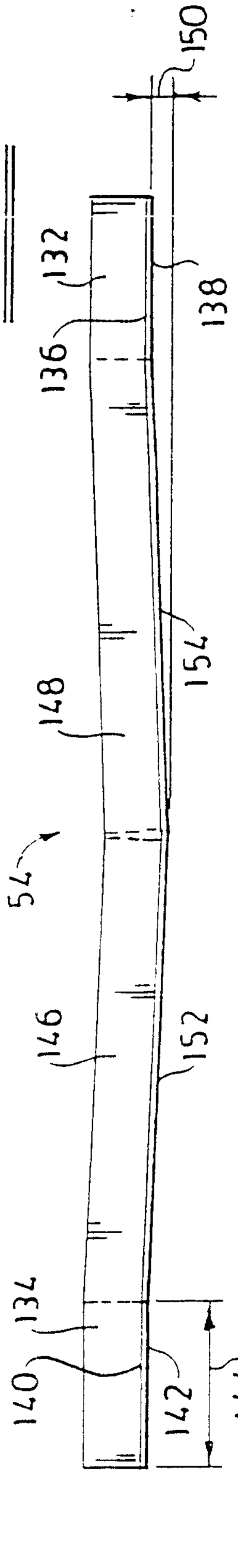



FIG. 9

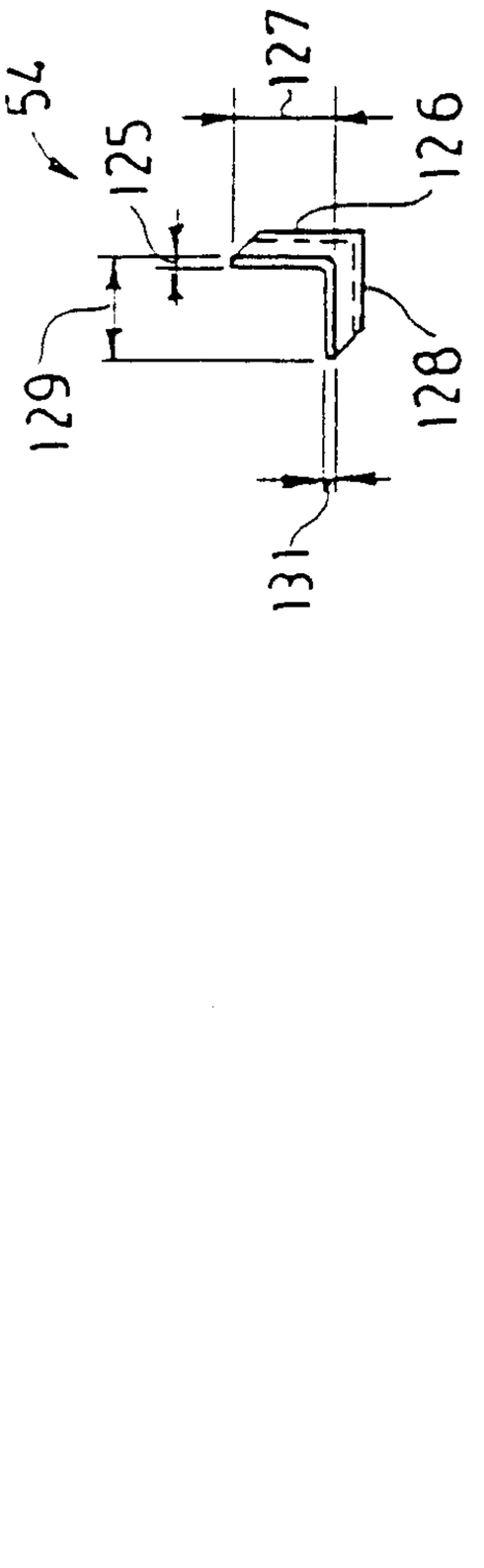



FIG. 10

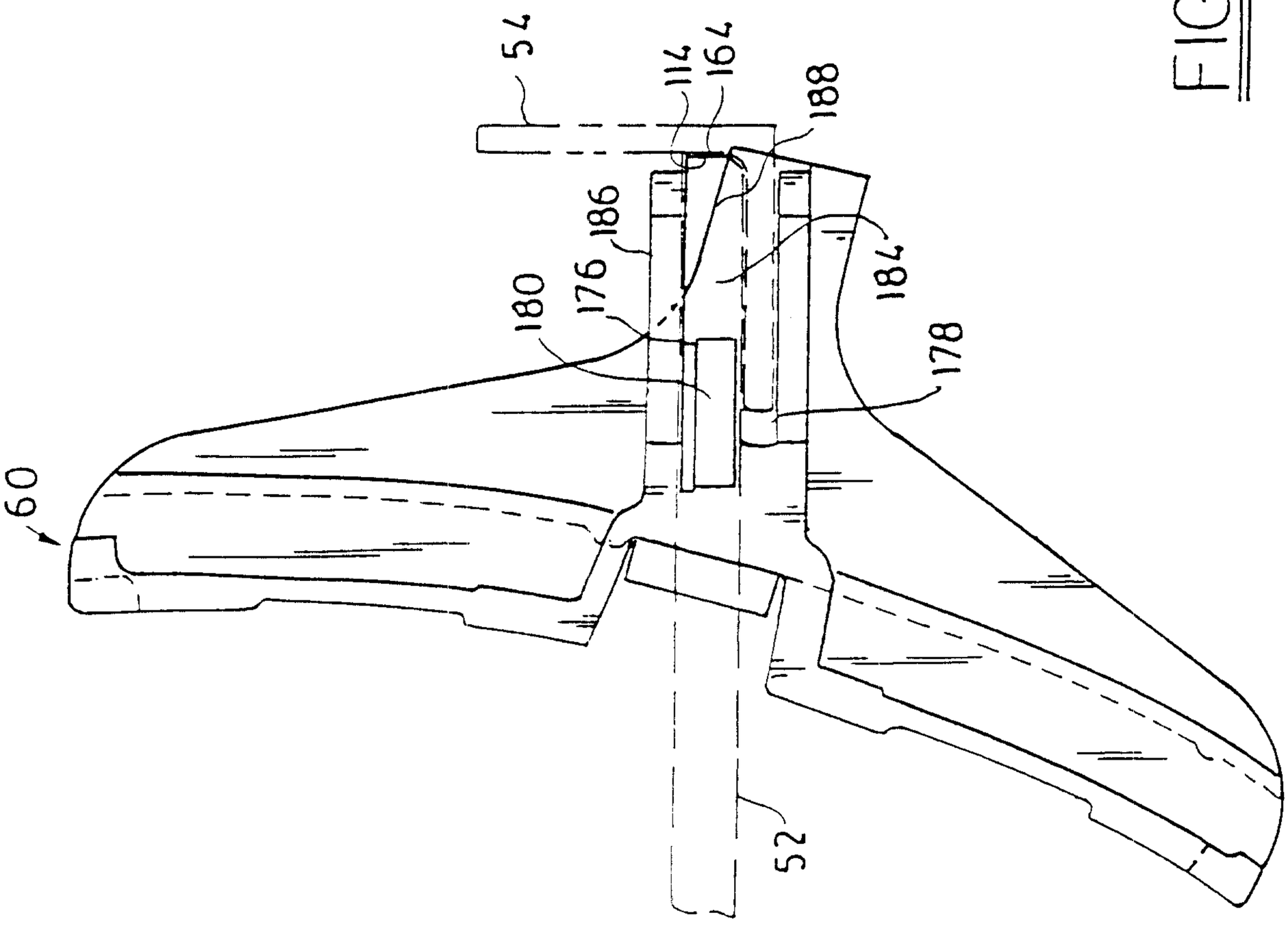



FIG.11

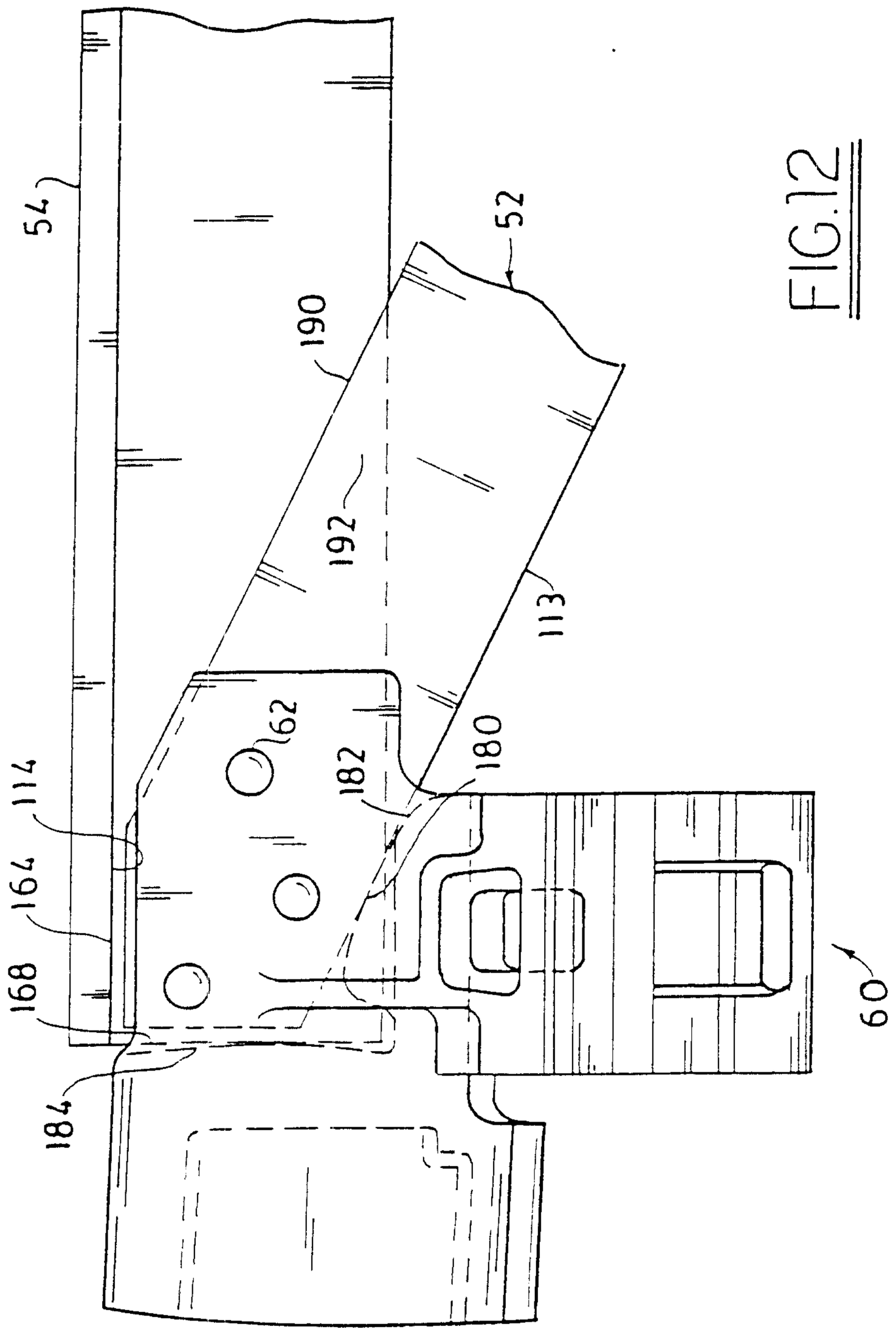



FIG.12

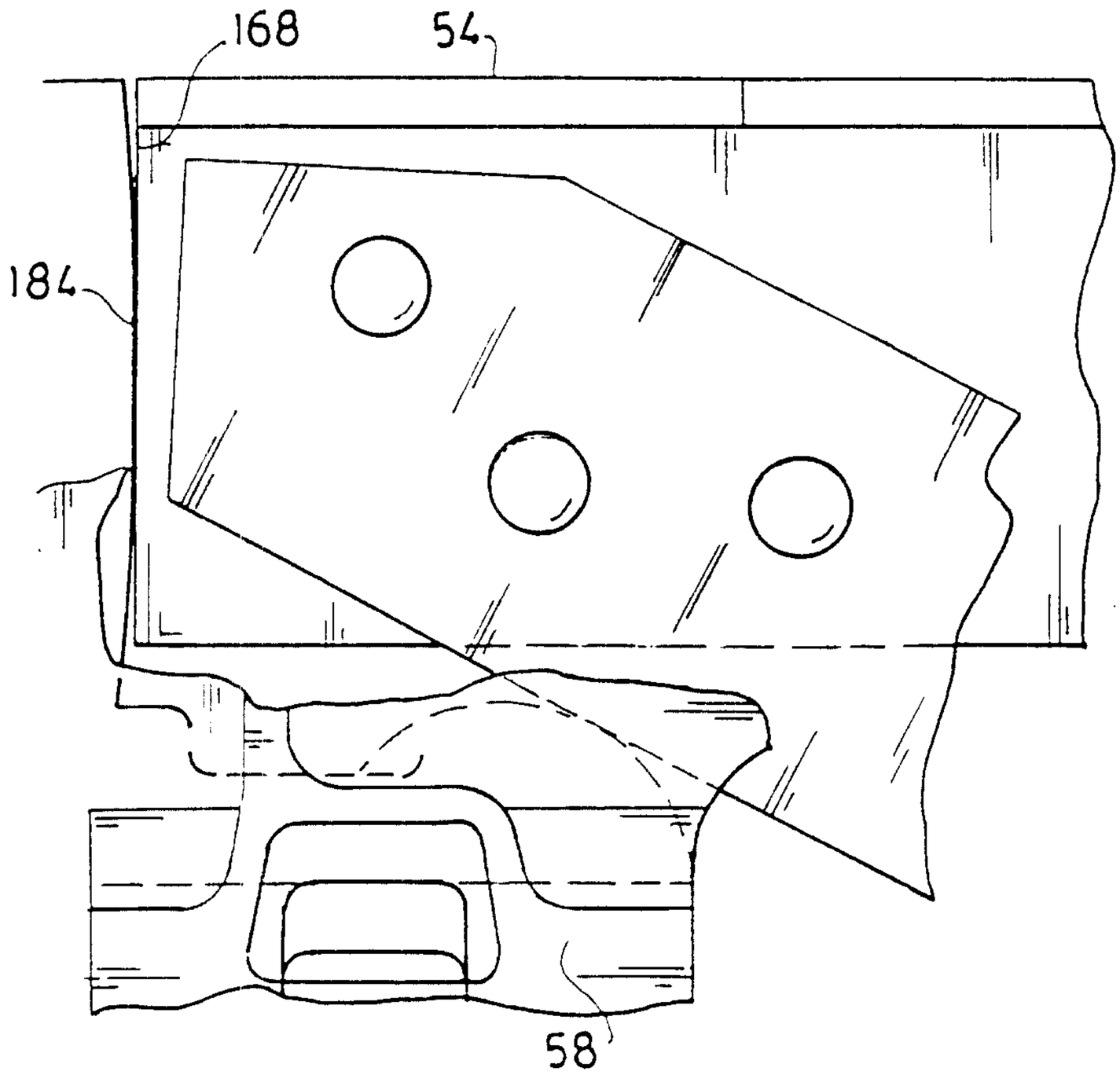



FIG.12 A

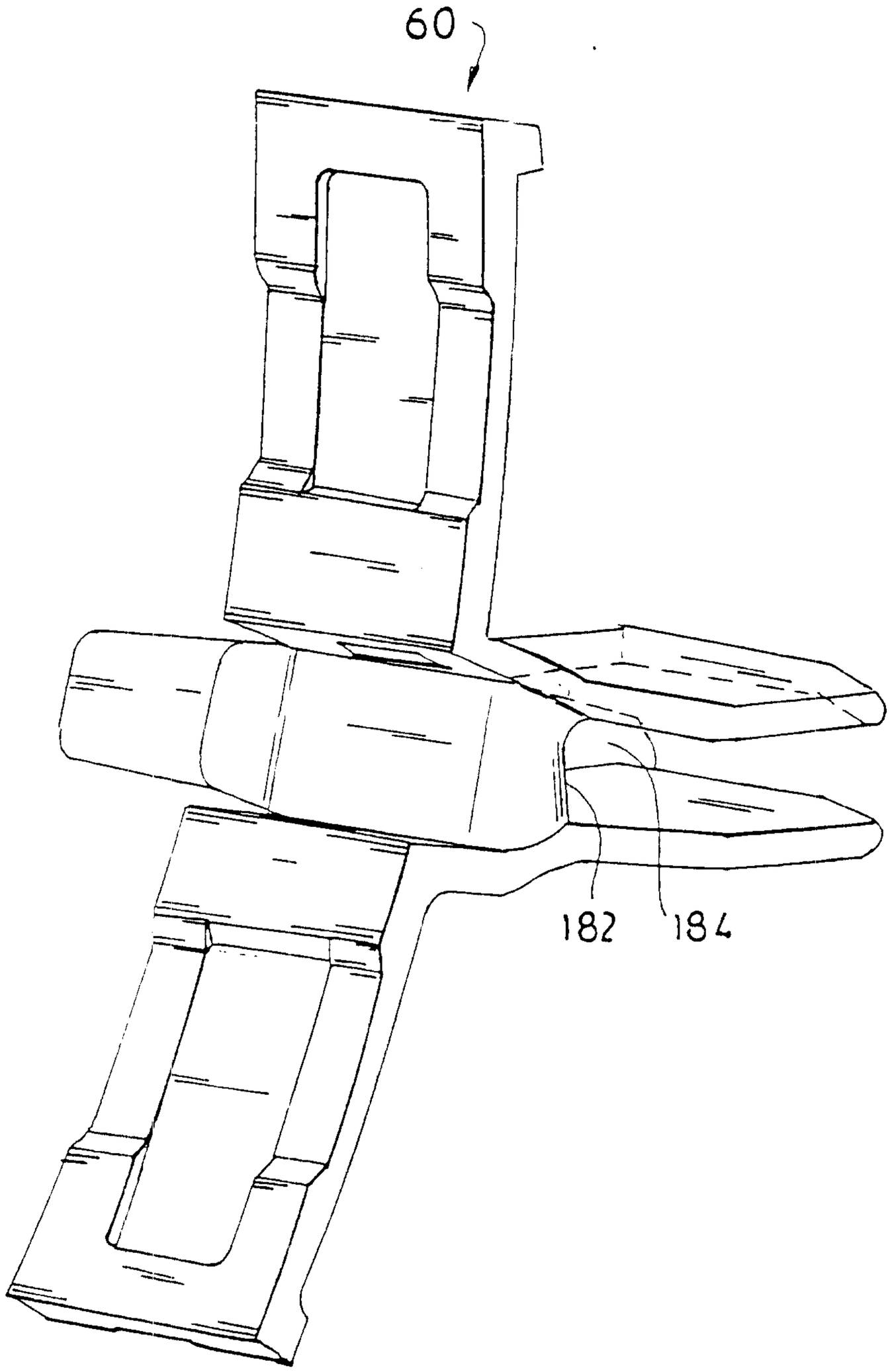



FIG. 13

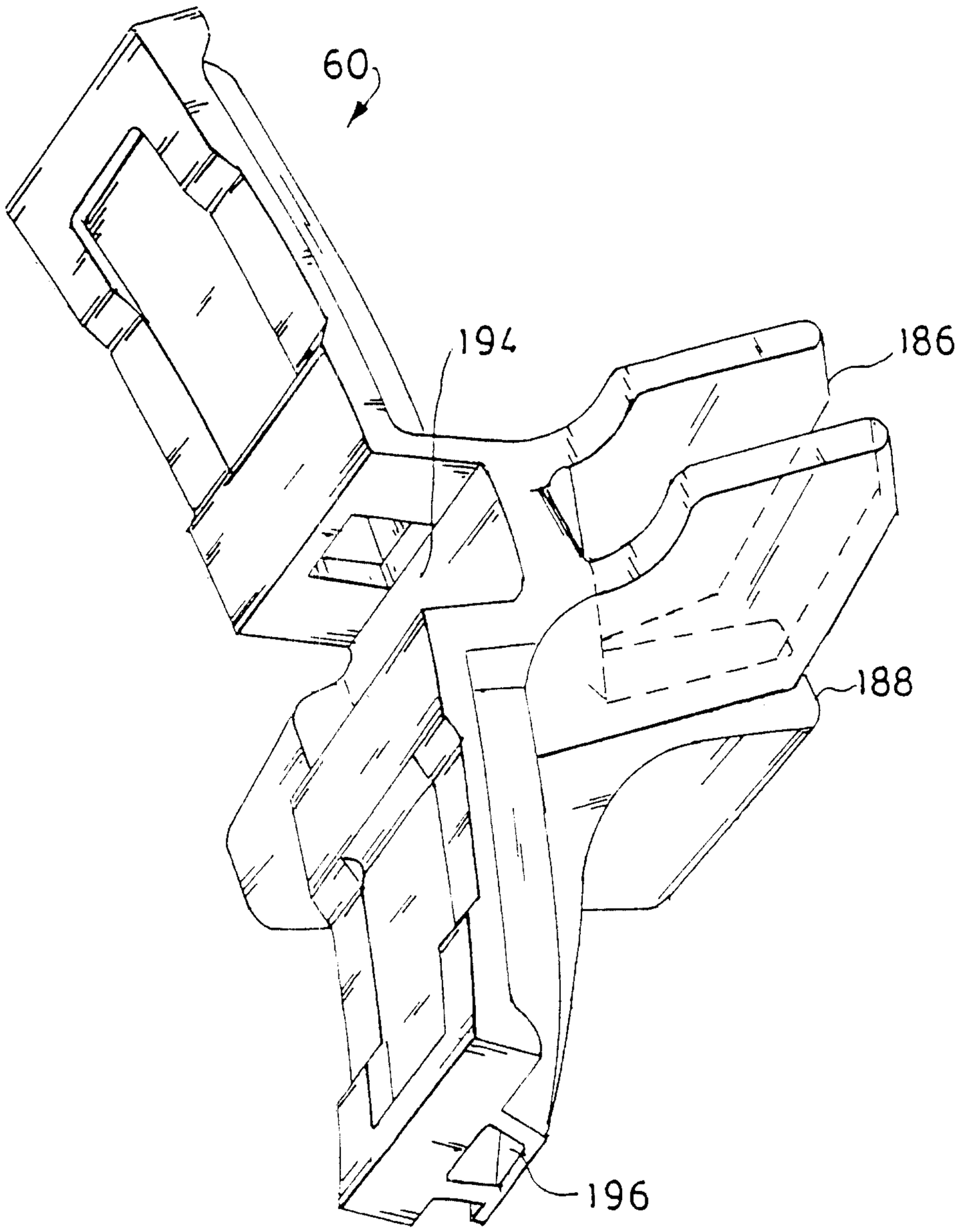



FIG. 14

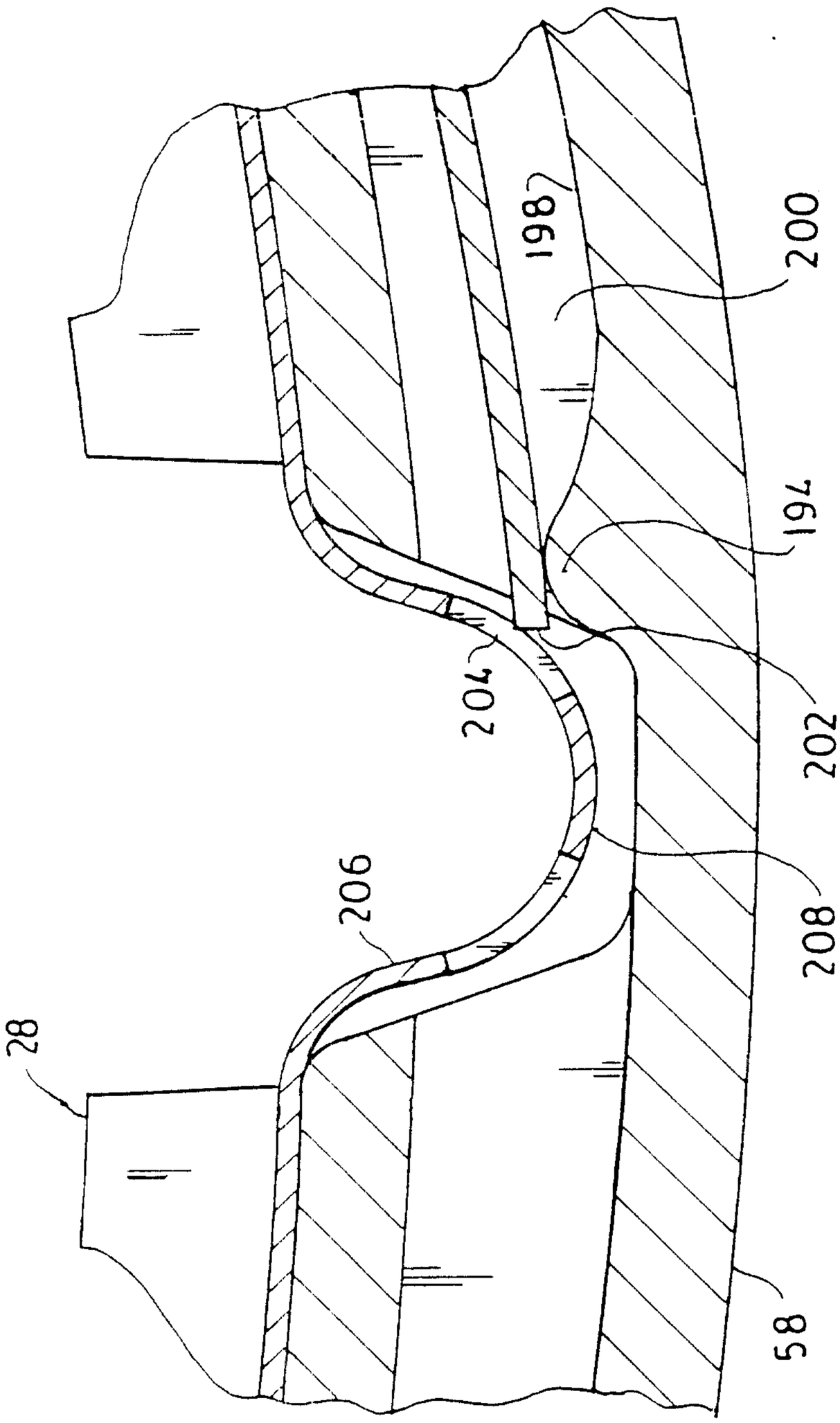



FIG. 15

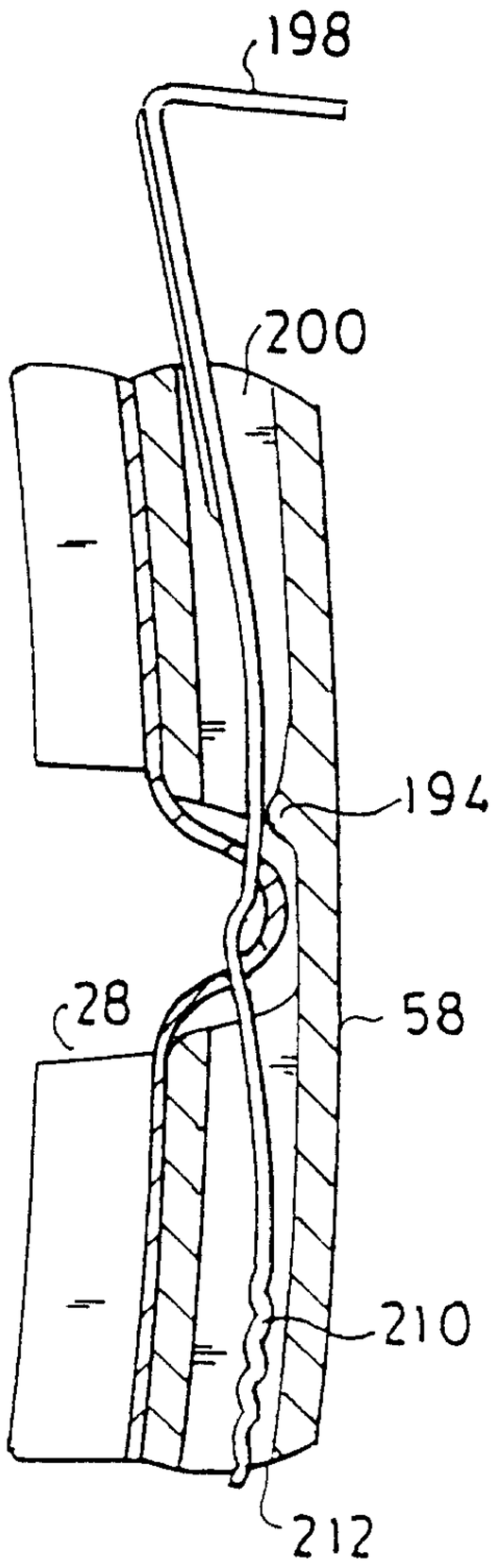



FIG. 16A

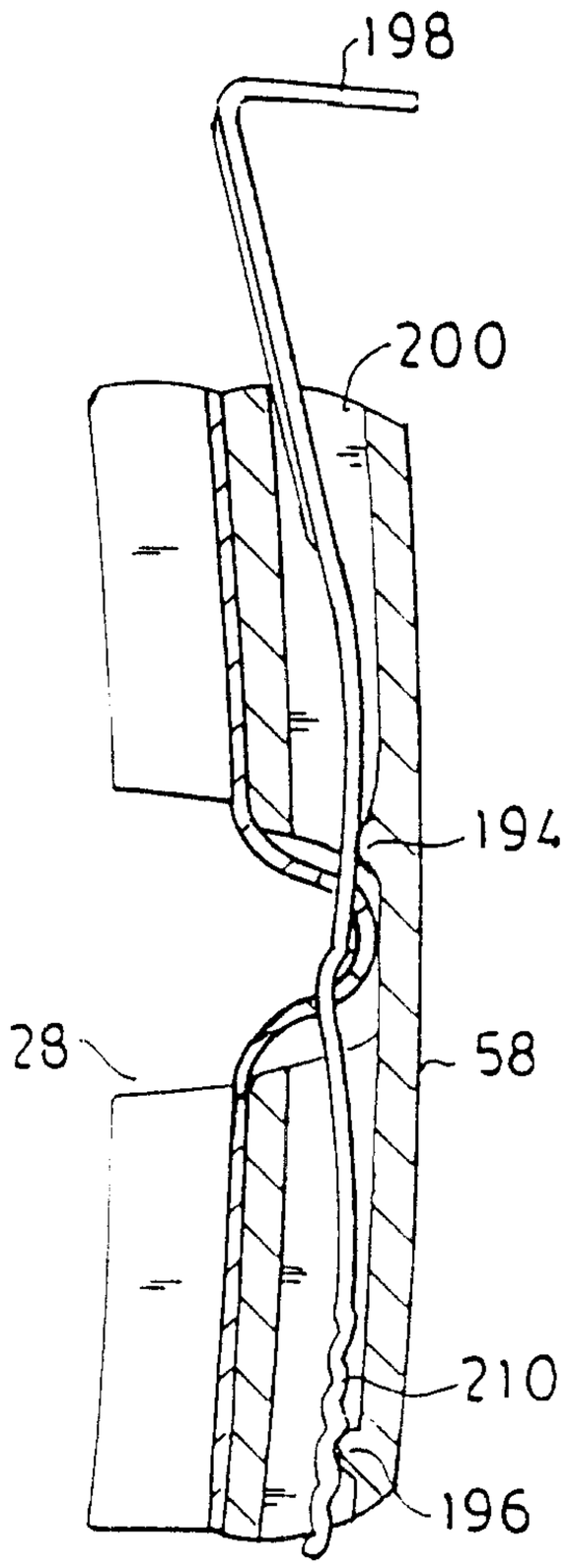



FIG. 16B

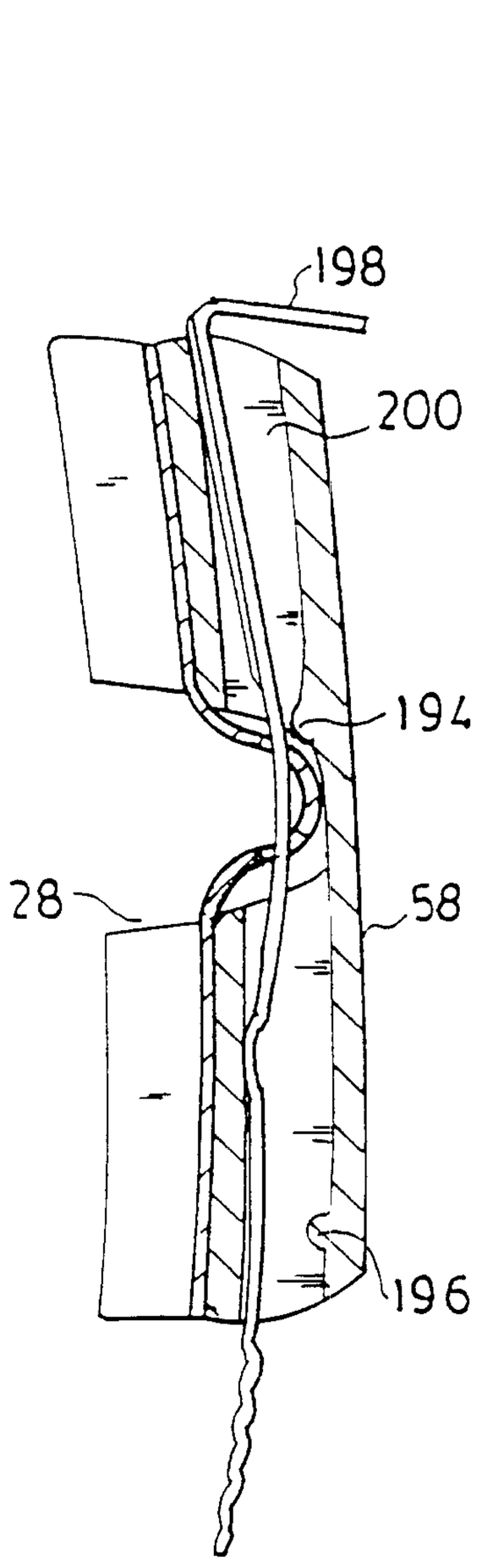



FIG. 16C

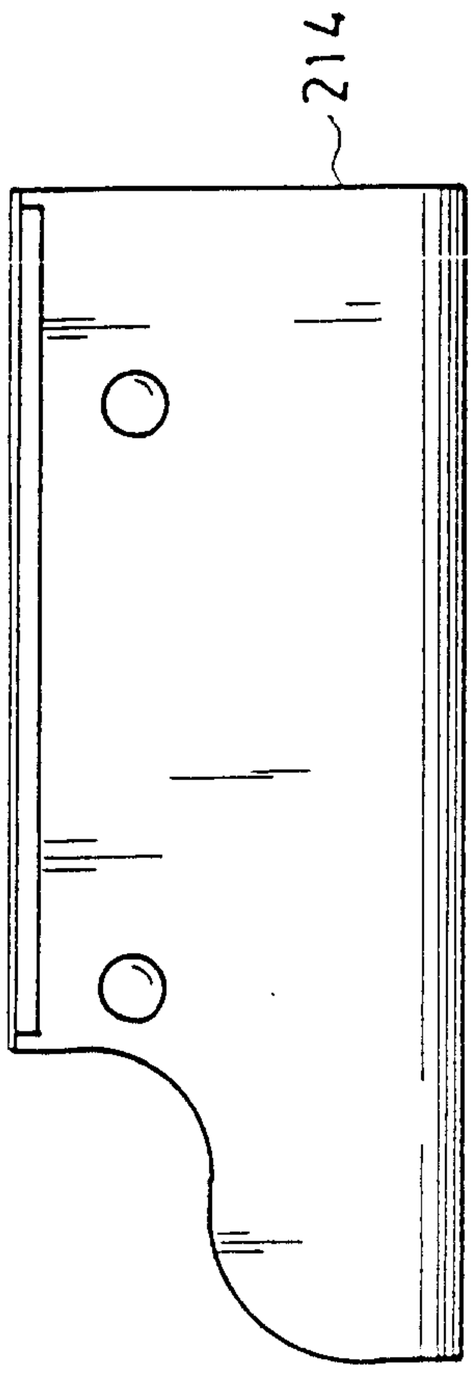



FIG. 17A

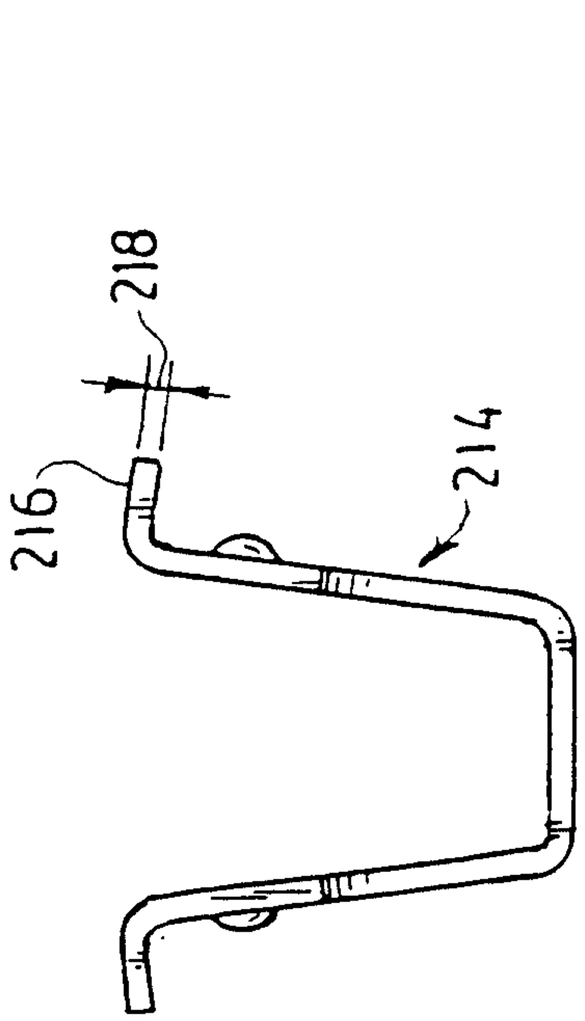



FIG. 17B

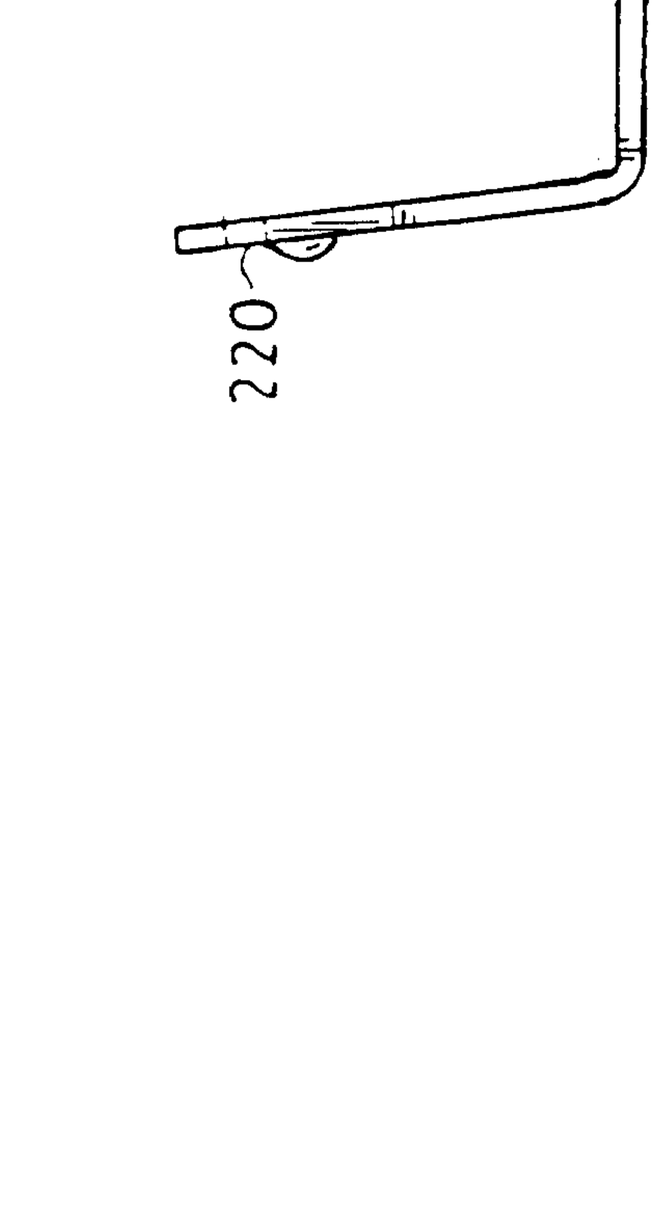



FIG. 18

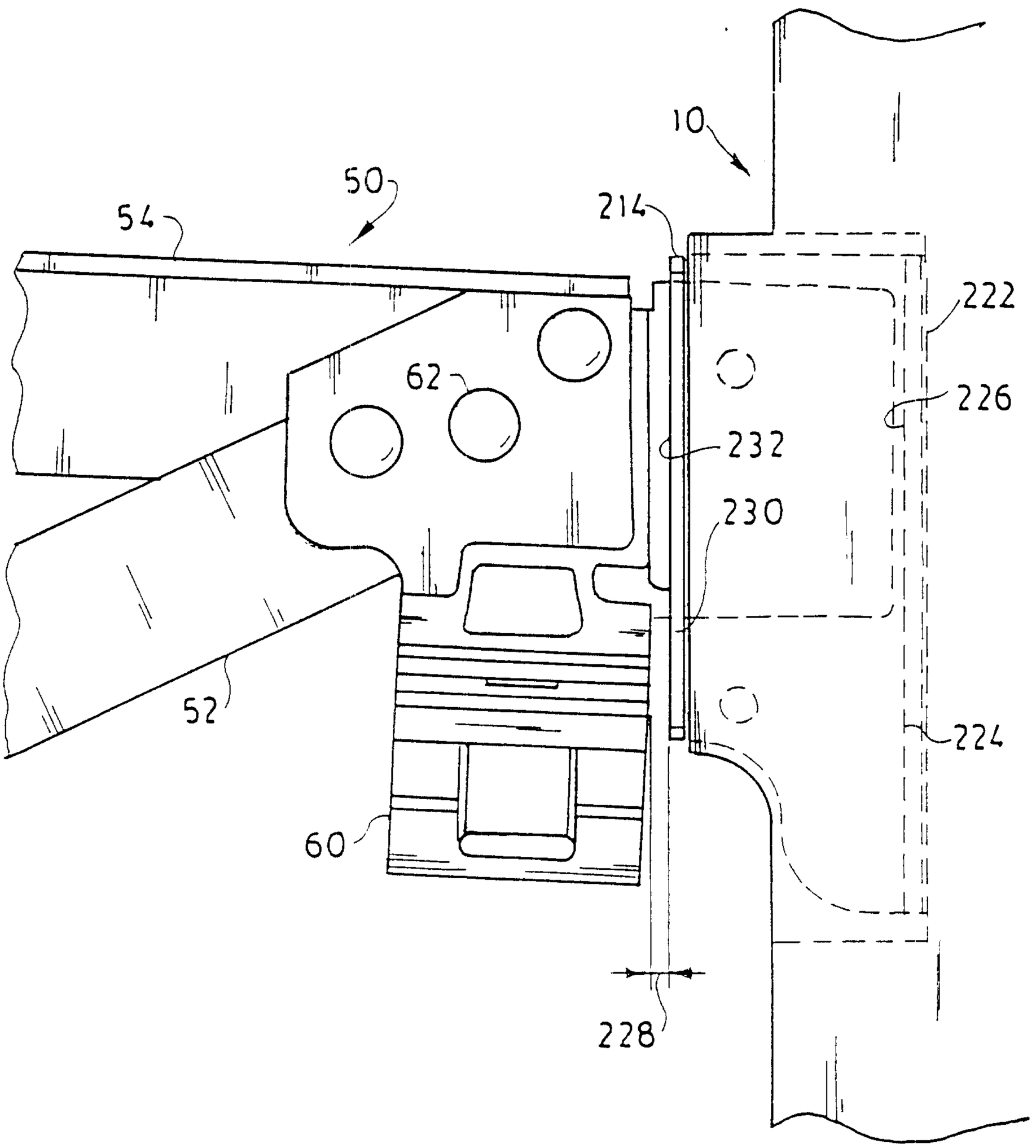



FIG.19

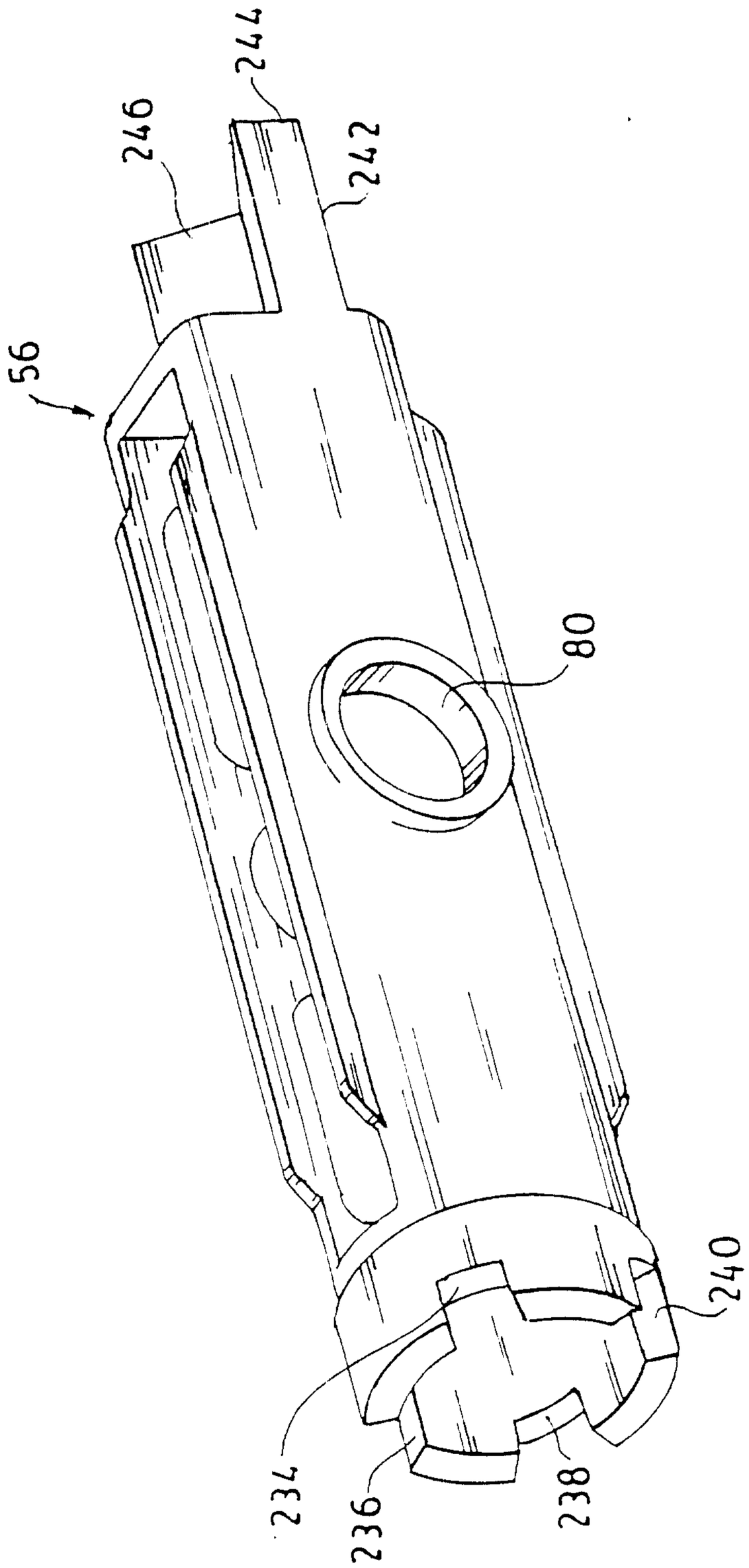



FIG.20

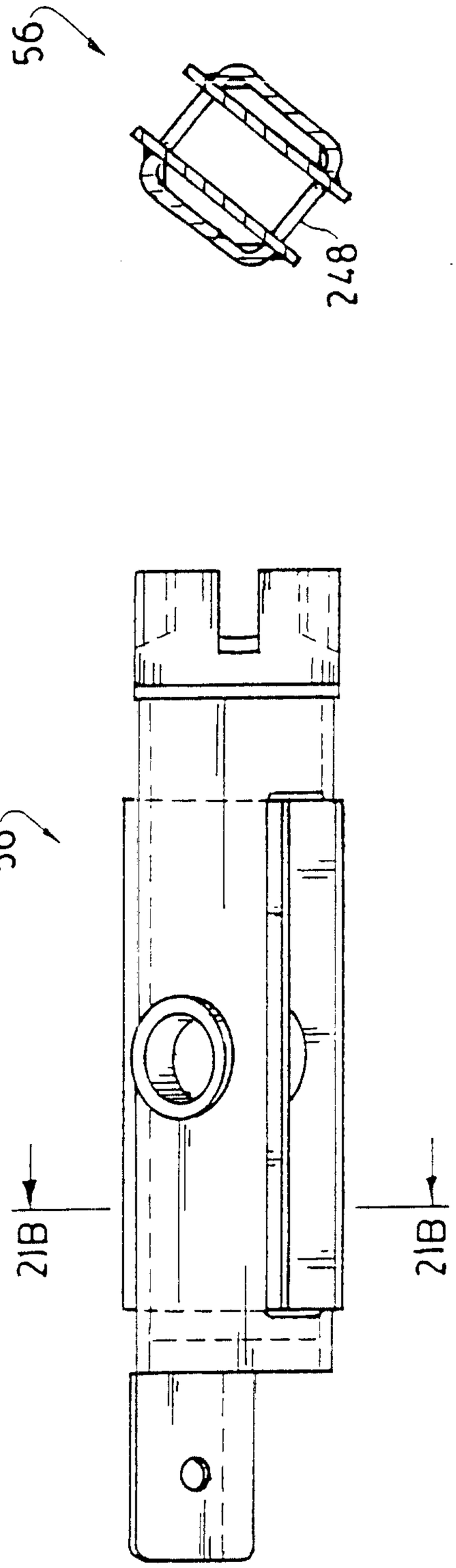



FIG.21B

FIG.21A

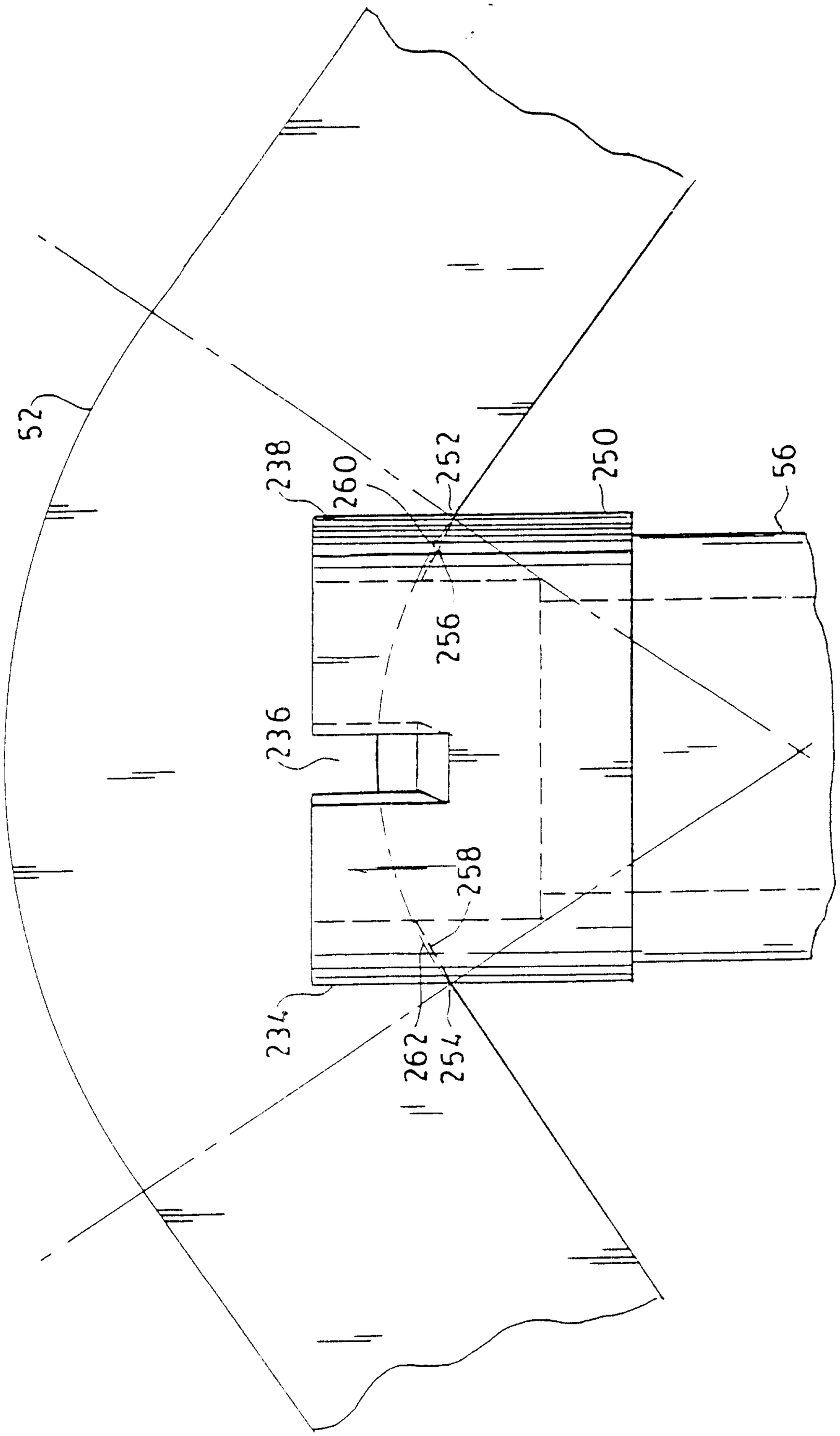



FIG. 22

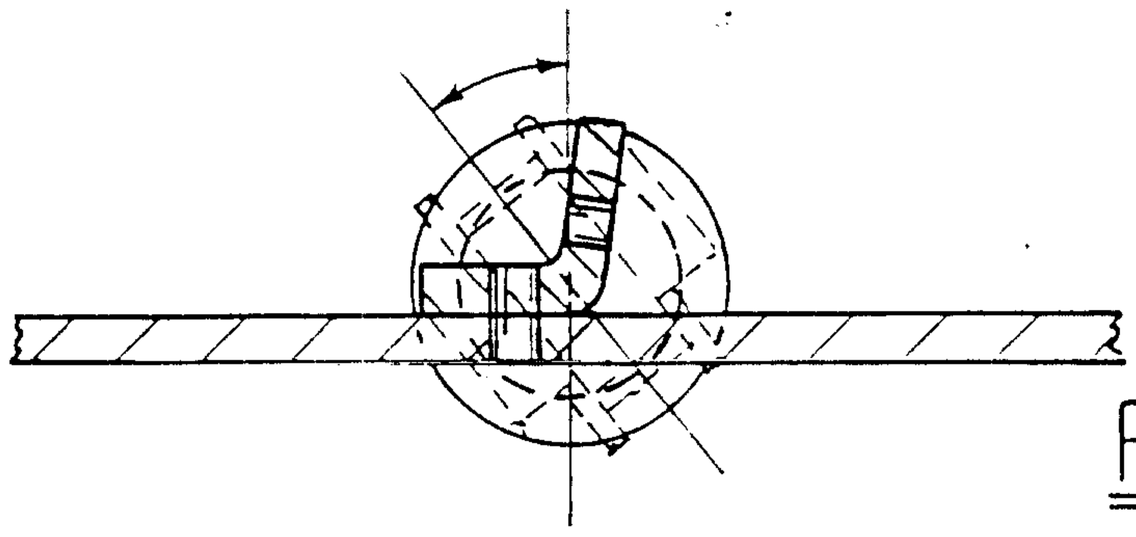


FIG. 23A



FIG. 23B

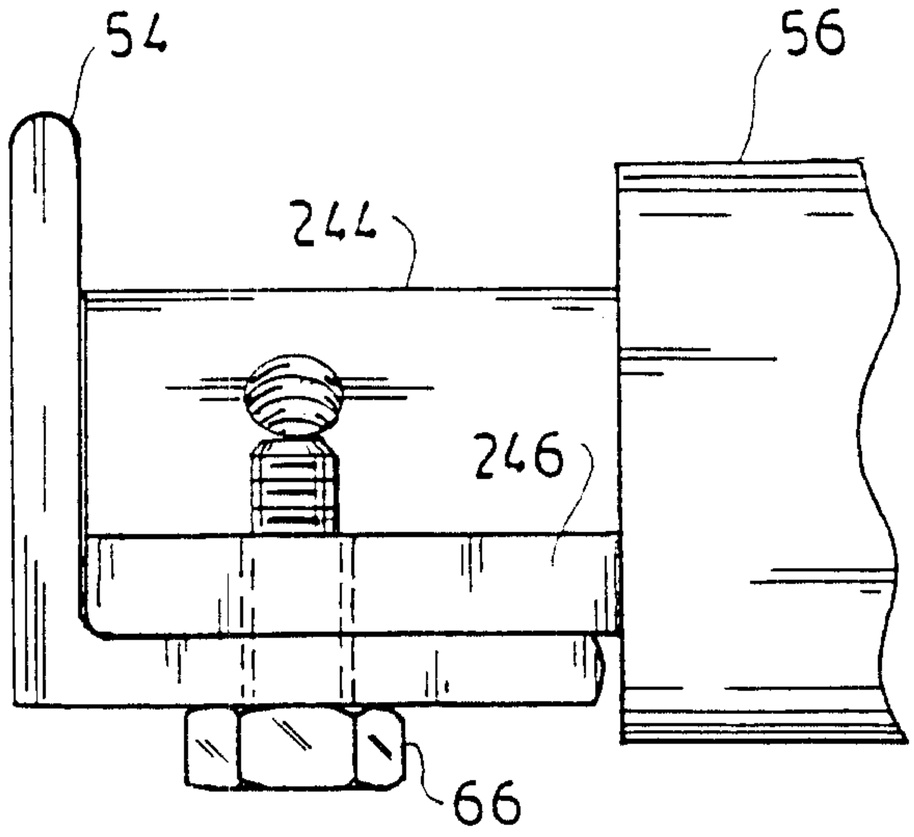



FIG. 24

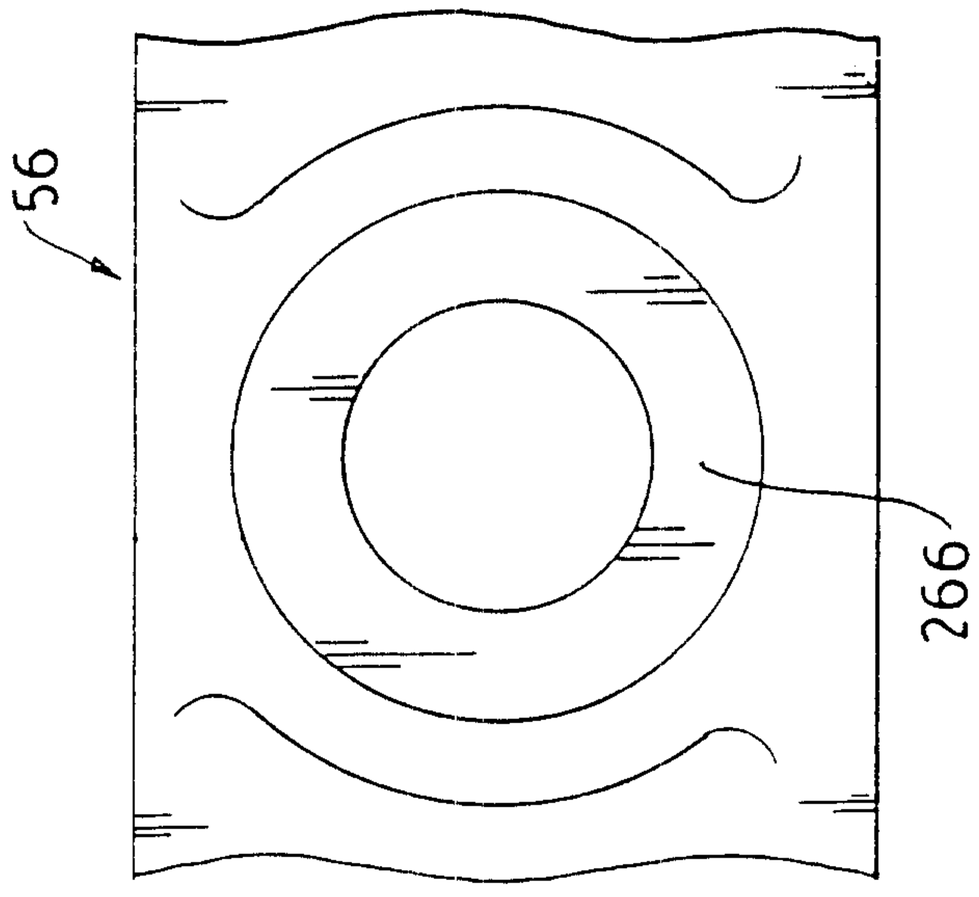



FIG. 25B

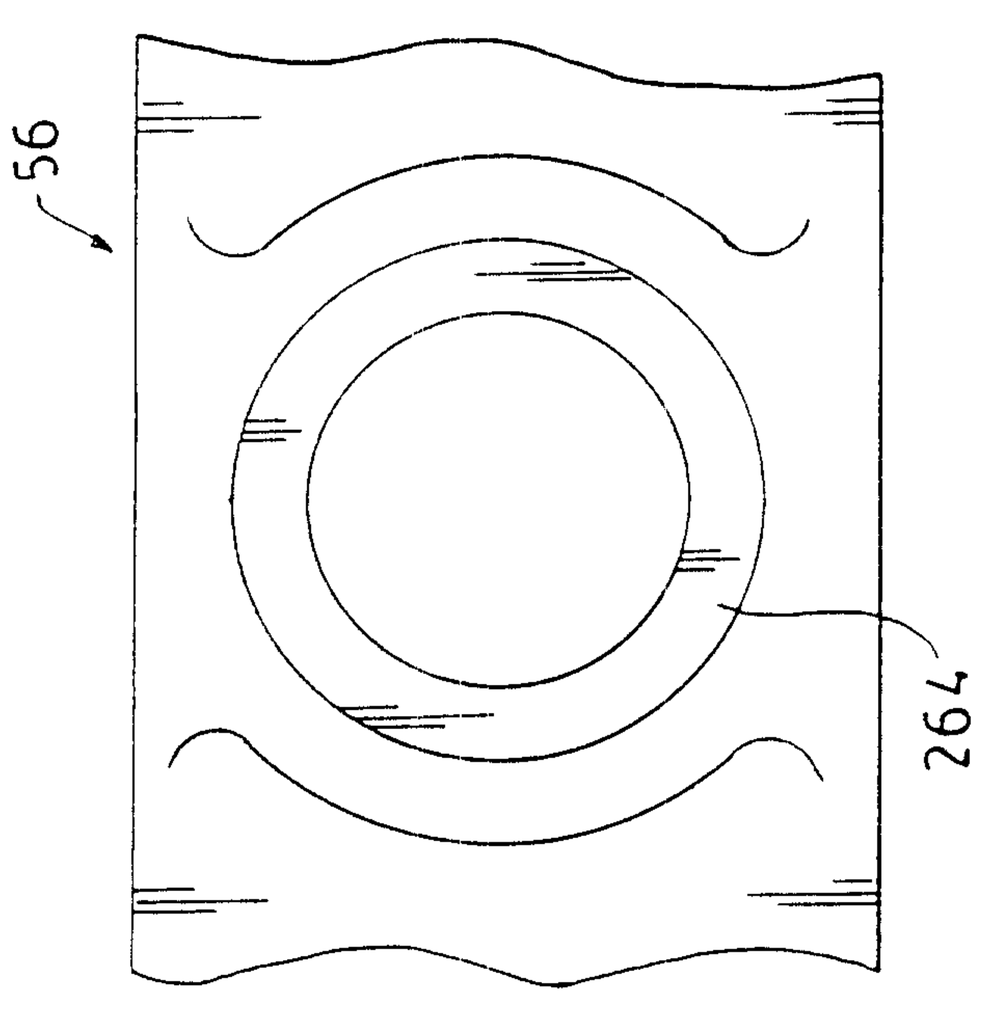



FIG. 25A

FIG.26A

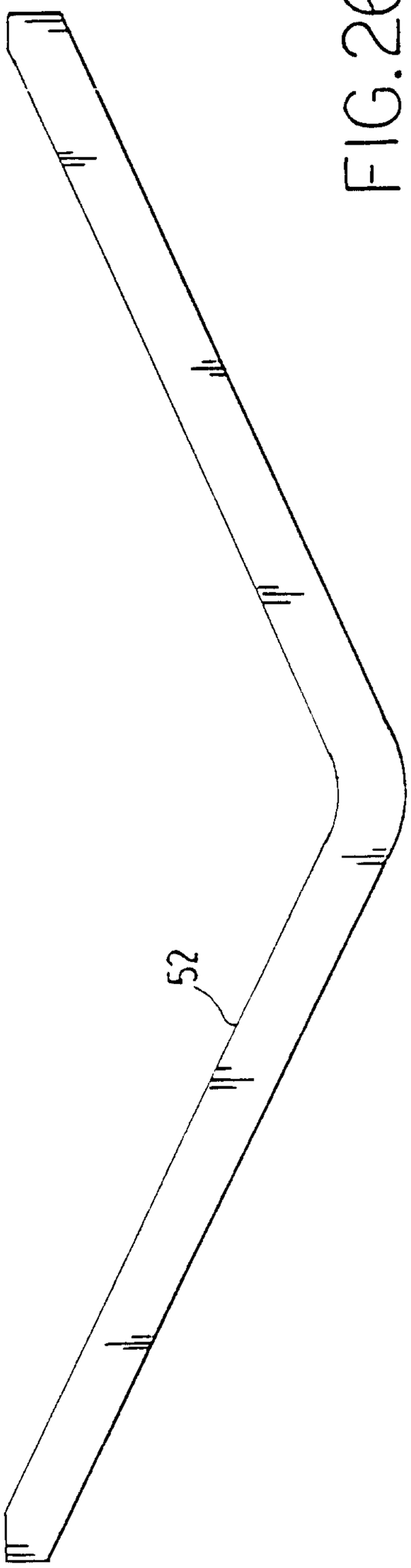
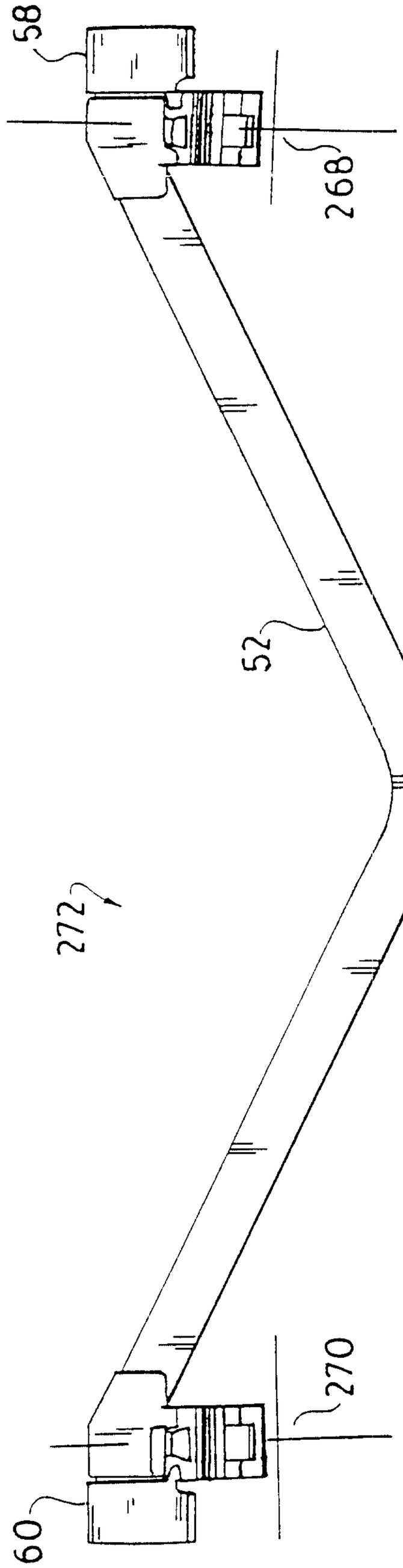



FIG.26B



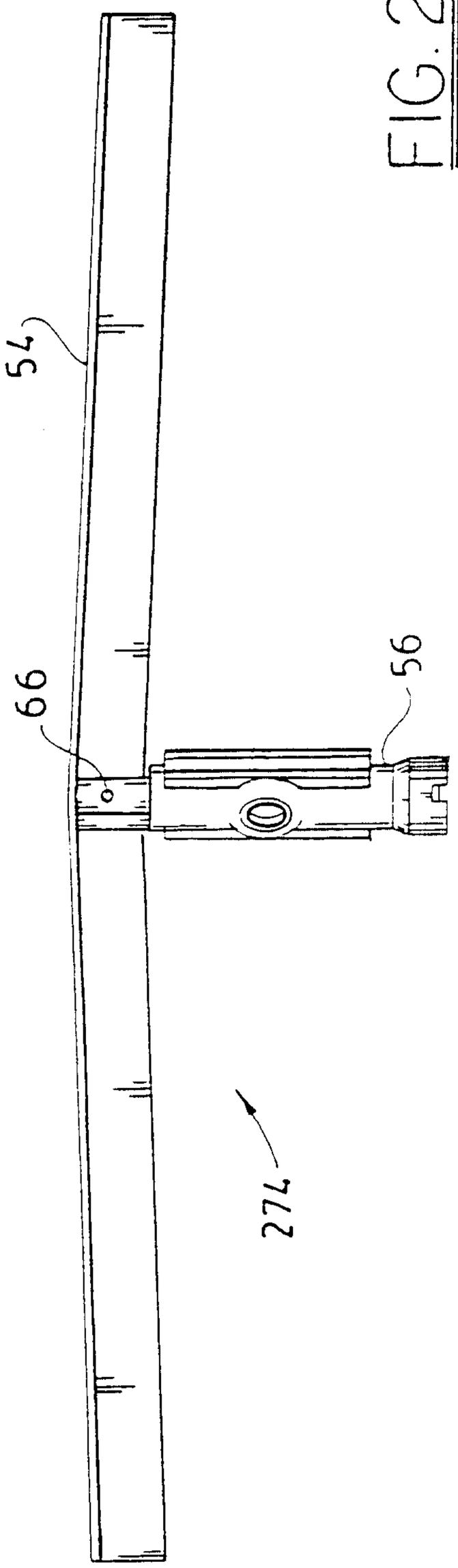



FIG. 26C

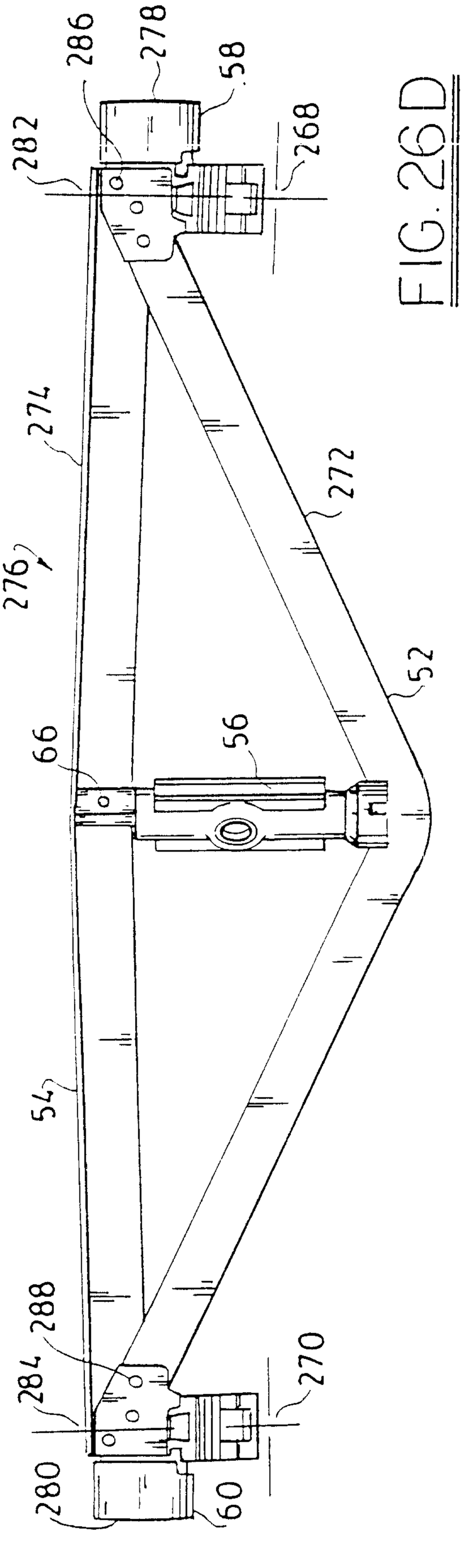



FIG. 26D

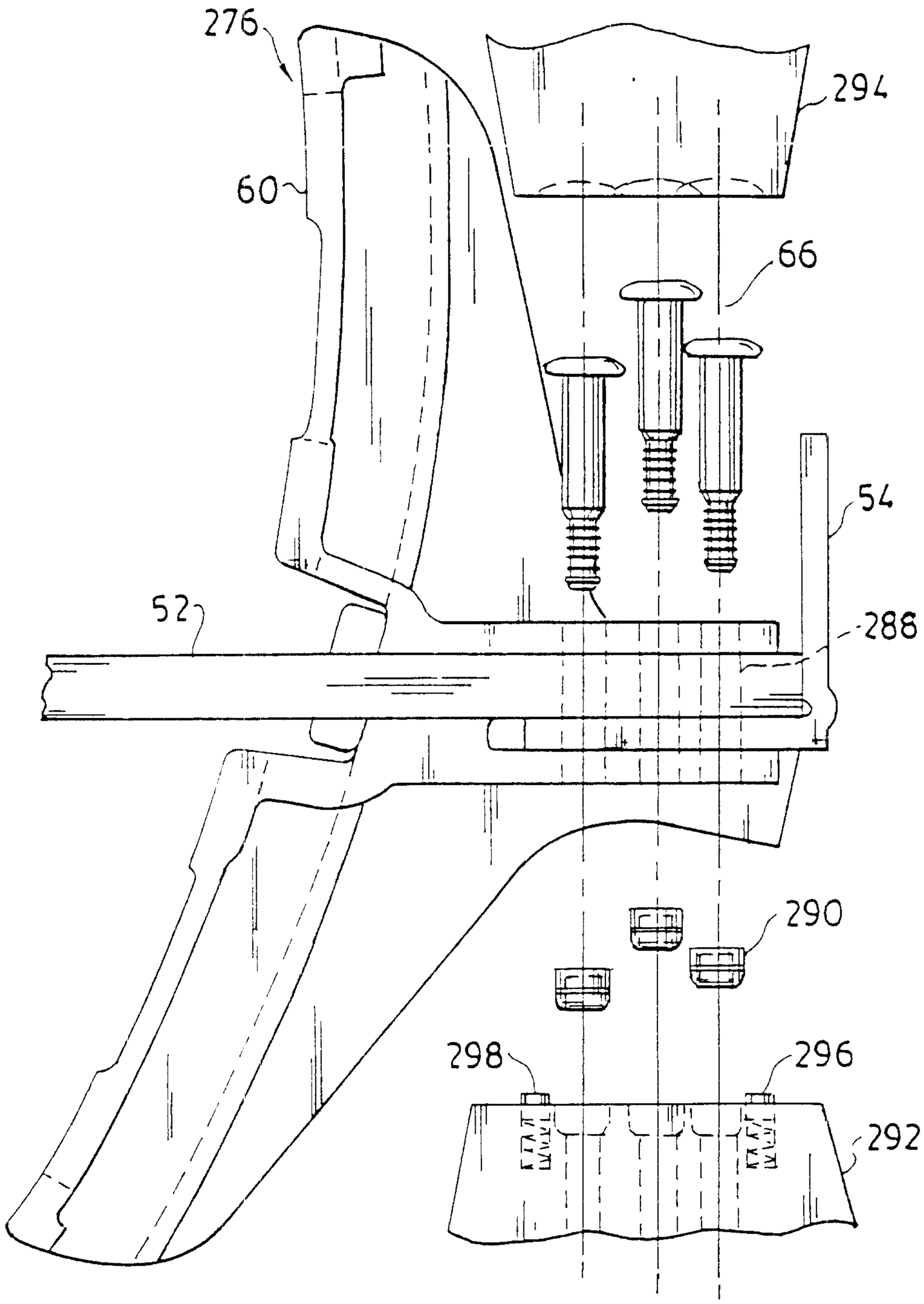
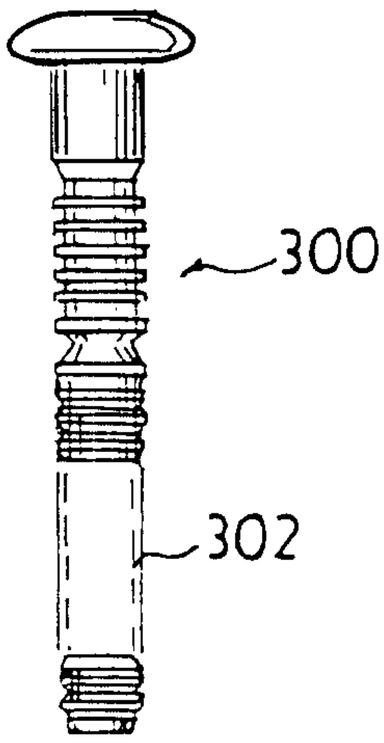



FIG. 27

FIG. 28A



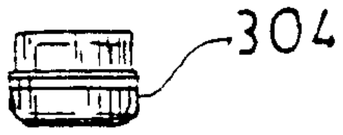
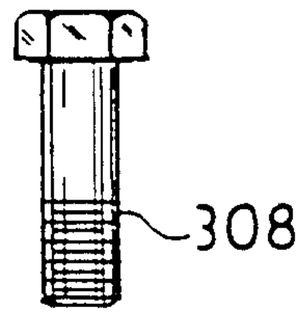




FIG. 28B


FIG. 28C

FIG. 29A



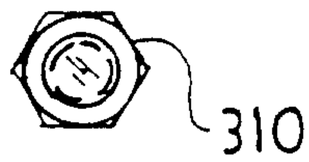




FIG. 29B

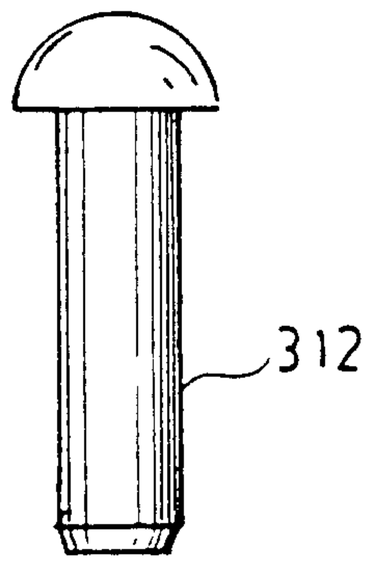



FIG. 30

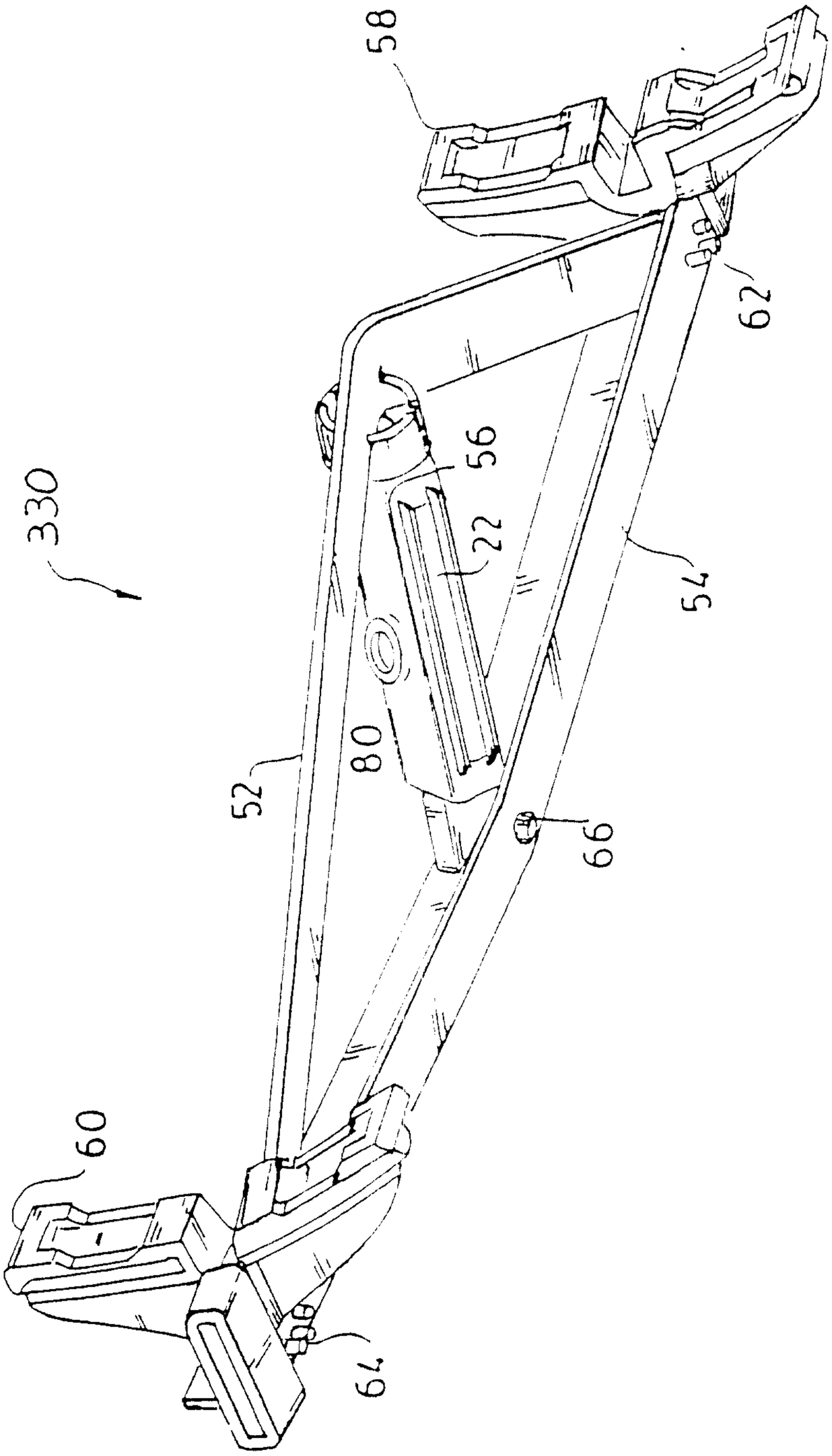



FIG. 31A

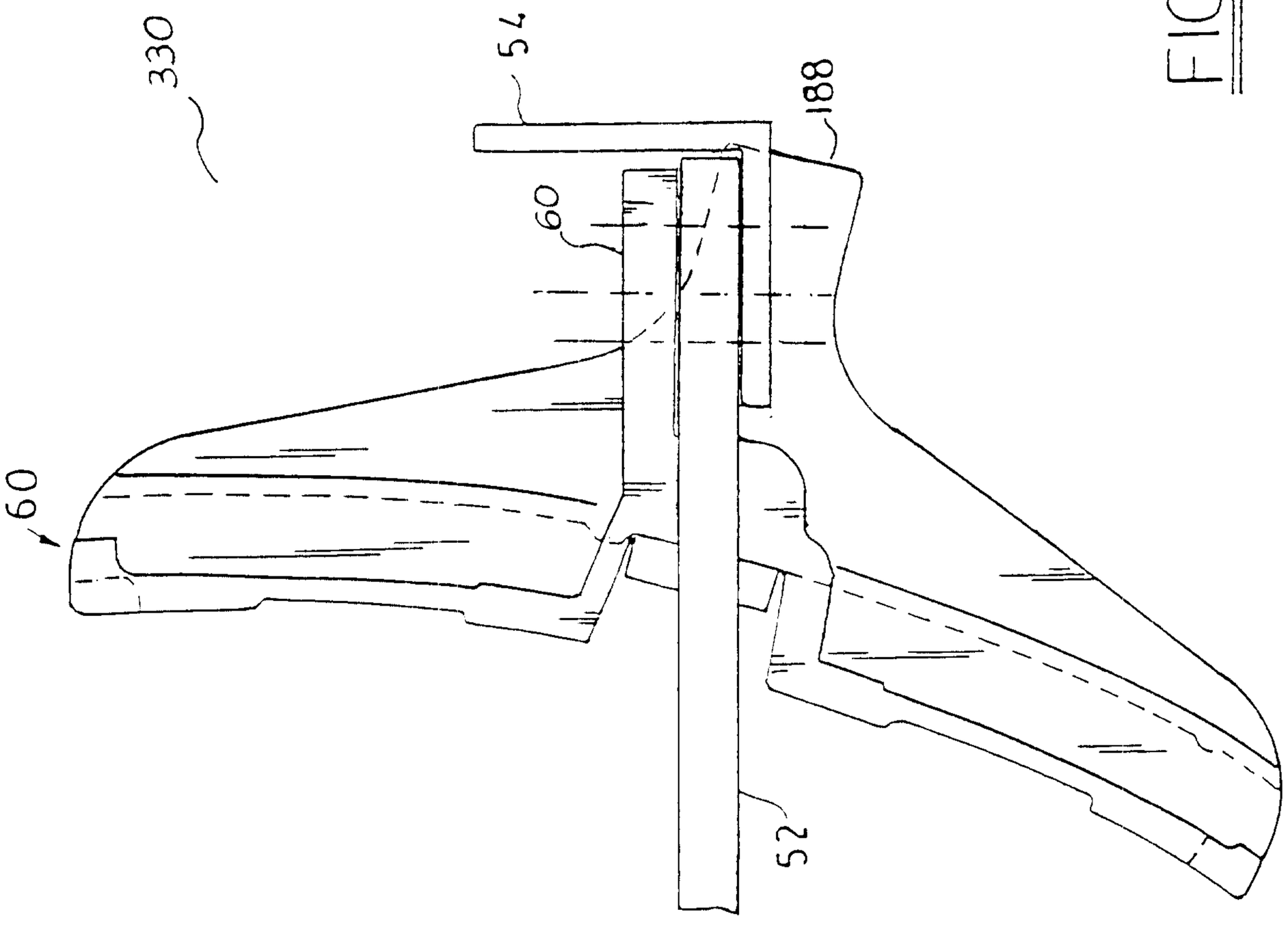



FIG. 31B

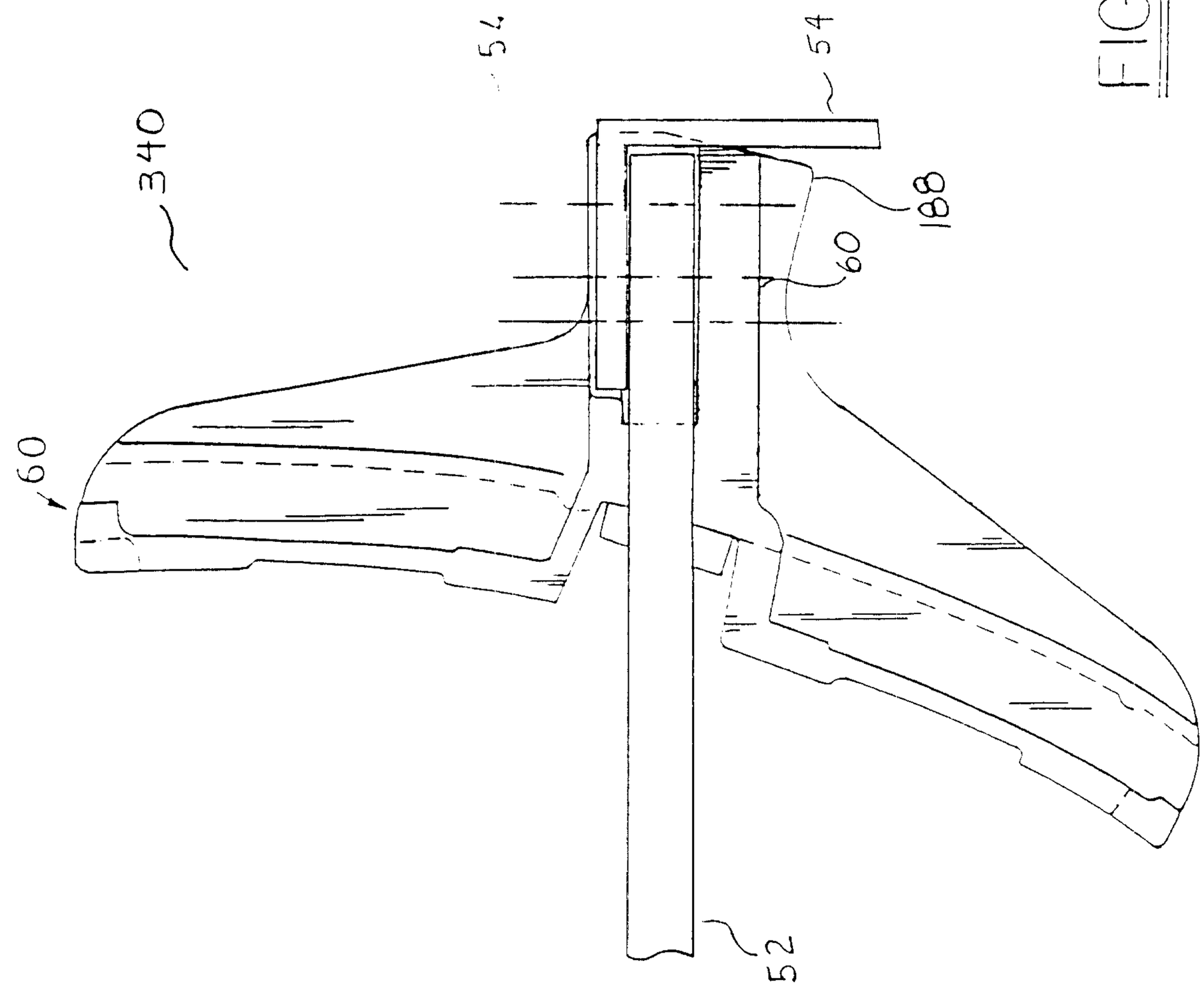



FIG. 31C

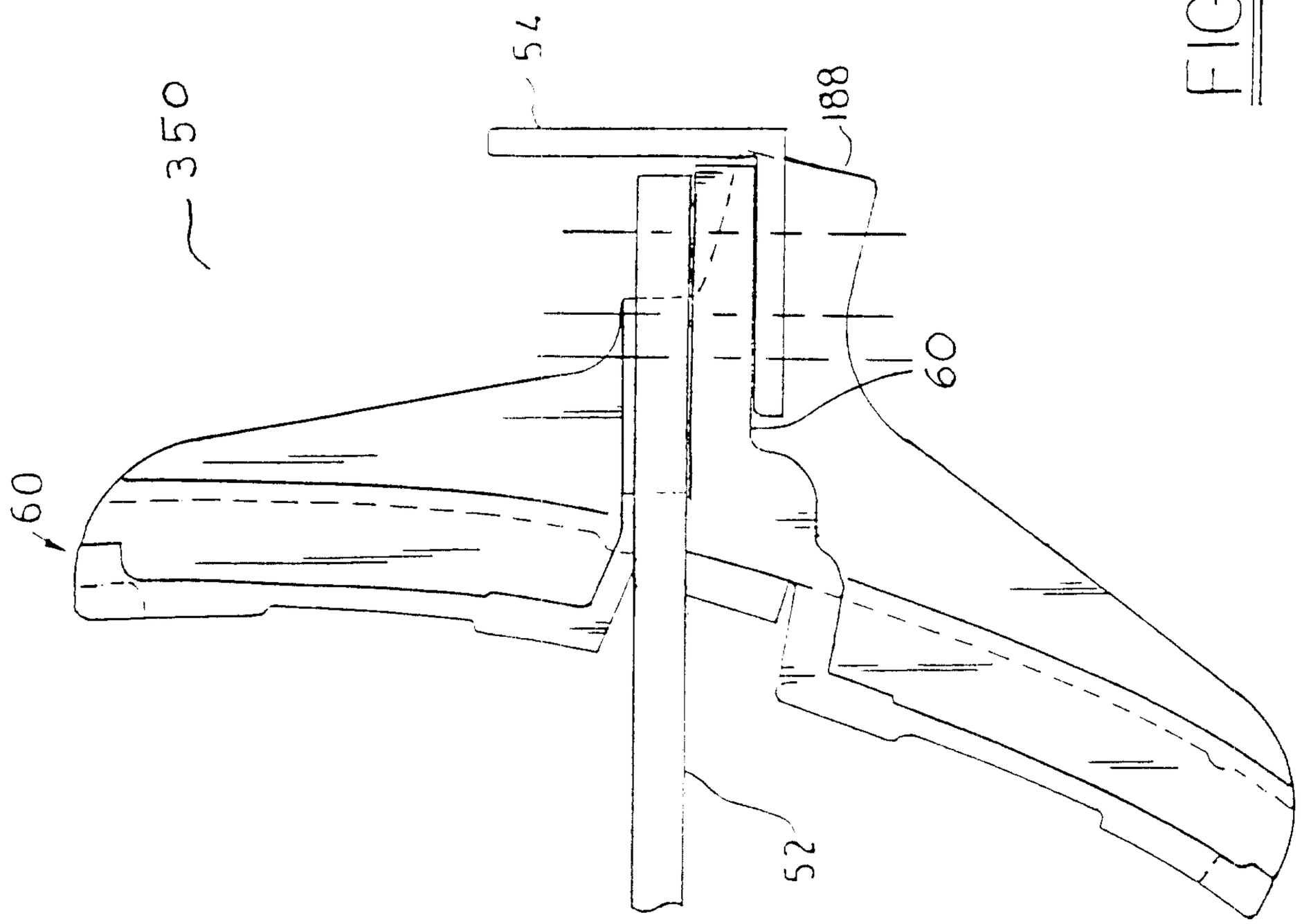



FIG.31D

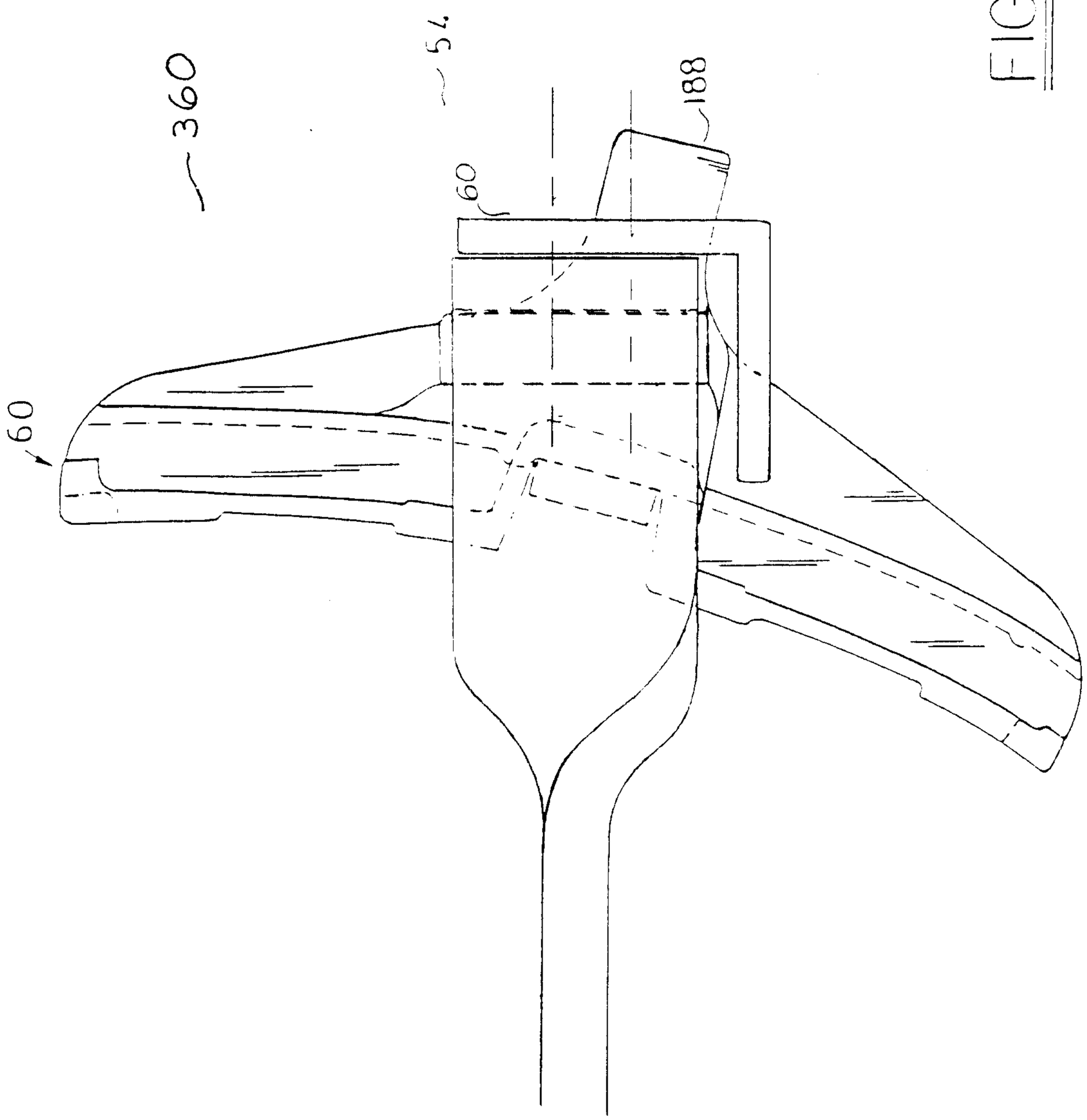
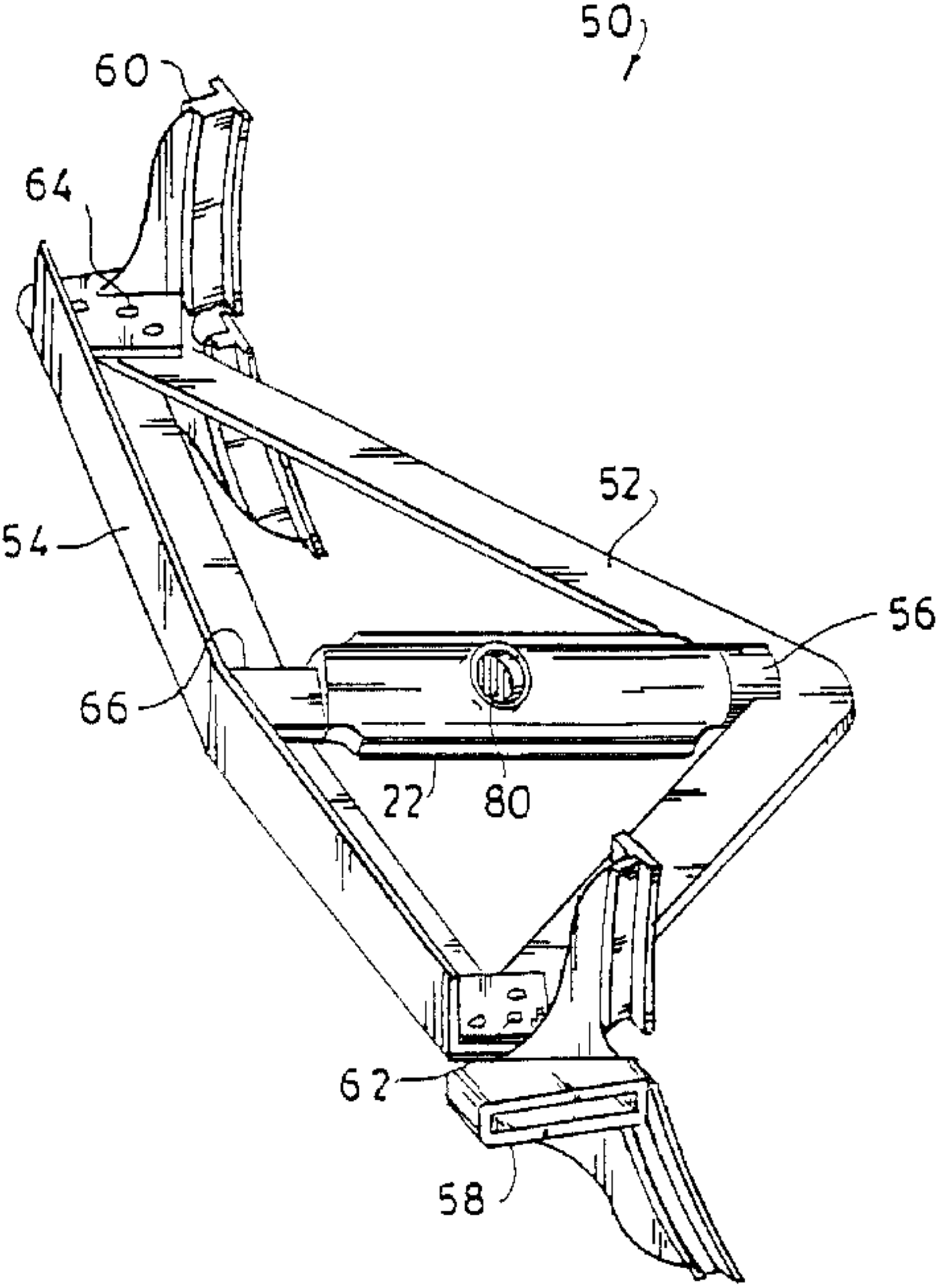



FIG. 31E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