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(54) Title: RETRACTABLE MEMBERS AND SYSTEMS FOR FOOT WEAR

(57) Abstract: Embodiments of the present invention are directed to retractable members for use on shoes, boots and other footwear. Various embodiments are directed to a retractable member actuation systems that can facilitate the extension and retraction of retractable members such as cleats. The various embodiments include retractable members and/or components of the retractable member actuation system that may be separate from or molded as part of the sole material, such as the tread face or tread block material, or the inner sole.

RETRACTABLE MEMBERS AND SYSTEMS FOR FOOT WEAR

Cross-Reference to Related Application

[0001] The present application claims priority to U.S. Provisional Application No. 61/115,402, filed on November 17, 2008, the entire disclosure of which is hereby incorporated by reference in its entirety.

Technical Field

[0002] Embodiments of the present invention relate to footwear, such as boots, shoes, specialty field shoes, woman's shoes, etc, and, more particularly, to retractable members and retractable member systems adapted to control extension and retraction of the retractable members relative to the bottom of the footwear.

Background

[0003] Specialty footwear is currently available for a variety of sports and other activities. For example, shoes used in some sports include cleats protruding from the bottom of the soles to improve traction and balance. Roller skates include wheels affixed to the sole of a shoe, allowing the user to glide along a flat surface such as pavement. While mobility, balance and traction may be enhanced by the specialty footwear currently available, the utility of such footwear is limited. Non-specialty footwear is much more versatile but is less than optimal for users on slick surfaces or for users who wish to alter their traction, mode of transport, height, etc. While footwear users have the option of bringing specialty footwear for use as needed, a better option is to increase the versatility of specialty and non specialty footwear.

Brief Description of the Drawings

[0004] Embodiments of the present invention will be readily understood by the following detailed description in conjunction with the accompanying drawings. Embodiments of the invention are illustrated by way of example and not by way of limitation in the figures of the accompanying drawings.

[0005] **Figures 1A-1D** illustrate a retractable member and retractable member control system in accordance with various embodiments;

[0006] **Figures 2A-2L** illustrate a retractable member control system in accordance with various embodiments;

[0007] **Figures 3A-3L** illustrate a retractable member control system in accordance with various embodiments; and

[0008] **Figures 4A-4H** illustrate a retractable member control system in accordance with various embodiments.

Detailed Description of Embodiments

[0009] In the following detailed description, reference is made to the accompanying drawings which form a part hereof, and in which are shown by way of illustration embodiments in which the disclosure may be practiced. It is to be understood that other embodiments may be utilized and structural or logical changes may be made without departing from the scope of the present disclosure. Therefore, the following detailed description is not to be taken in a limiting sense, and the scopes of embodiments, in accordance with the present disclosure, are defined by the appended claims and their equivalents.

[0010] Various operations may be described as multiple discrete operations in turn, in a manner that may be helpful in understanding embodiments of the present invention; however, the order of description should not be construed to imply that these operations are order dependent.

[0011] The description may use perspective-based descriptions such as up/down, back/front, and top/bottom. Such descriptions are merely used

to facilitate the discussion and are not intended to restrict the application of embodiments of the present invention.

[0012] The terms "coupled" and "connected," along with their derivatives, may be used. It should be understood that these terms are not intended as synonyms for each other. Rather, in particular embodiments, "connected" may be used to indicate that two or more elements are in direct physical or electrical contact with each other. "Coupled" may mean that two or more elements are in direct physical or electrical contact. However, "coupled" may also mean that two or more elements are not in direct contact with each other, but yet still cooperate or interact with each other.

[0013] For the purposes of the description, a phrase in the form "A/B" or in the form "A and/or B" means (A), (B), or (A and B). For the purposes of the description, a phrase in the form "at least one of A, B, and C" means (A), (B), (C), (A and B), (A and C), (B and C), or (A, B and C). For the purposes of the description, a phrase in the form "(A)B" means (B) or (AB) that is, A is an optional element.

[0014] The description may use the phrases "in an embodiment," or "in embodiments," which may each refer to one or more of the same or different embodiments. Furthermore, the terms "comprising," "including," "having," and the like, as used with respect to embodiments of the present invention, are synonymous.

[0015] Embodiments of the present invention are directed to retractable members for use on shoes, boots and other footwear. Various embodiments are directed to actuation systems for such retractable members. The various embodiments include retractable members and/or components of the retractable member actuation system that may be separate from or molded as part of the sole material, such as the tread face or tread block material, or the inner sole.

[0016] **Figures 1A-1D** illustrate various views of a retractable member actuation system in accordance with various embodiments of the present invention. An upper portion or inner cover **10** may be coupled to the sole of the footwear, either as an additional component or integrated as part of one

or more layers of the sole such as the inner or upper sole portion. A fluid responsive moving member, generally referred to as diaphragm **12** may be coupled to upper portion **10**, thereby forming a media or fluid chamber **14**. In various embodiments, a retractable member housing (or cleat housing as used in regard to the exemplified embodiment) **20** may be coupled to the inner cover **10** and include an upper cavity **18** which can accommodate movement of the diaphragm **12** towards the retractable member housing **20**. In various embodiments, one or more channels **16** may be adapted to direct fluid into the fluid chamber **14**, thereby causing expansion and retraction of the diaphragm **12**. Channels **16** may be formed within either sole layer and/or a combination of both as shown.

[0017] A retractable member stud **22** may have a first end portion **21** that helps couple the stud to the diaphragm **12**, rendering it movable therewith depending on pressurization and depressurization of the fluid chamber **14**. In various embodiments the first end **21** of the retractable member stud **22** may be coupled to the diaphragm in a number of ways, including but not limited to gluing and/or integrating the retractable member stud **22** as part of the diaphragm material. The stud **22** may have a second or distal end portion **23** adapted to allow a retractable member (e.g. a cleat) **24**, to couple thereto (for example, via a threaded arrangement). The stud **22** may have a body portion **25** that may be sized and/or shaped the same as or differently than the second end portion **23** and adapted to pass through a similarly sized and/or shaped aperture **27** in a retractable member stop **26** disposed in the retractable member housing **20**. In various embodiments, the geometric shape of the body portion **25** and corresponding stop aperture **27** may be such that rotation of the retractable member within the retractable member housing due to torsional forces encountered by the retractable member may be resisted.

[0018] The retractable member housing **20** may include a retractable member cavity **28** and sized to accommodate retractable member **24**. So configured, as the diaphragm **12** expands due to pressurization of the fluid chamber **14**, the retractable member **24** may move axially outward from the

retractable member cavity **28** and retractable member housing **20**. When the fluid is removed from fluid chamber **14**, the depressurization of the fluid chamber may allow the retractable member **24** to axially move back into the retractable member cavity **28** and retractable member housing **20**.

[0019] In various embodiments a retractable member seal **29** may be disposed about the retractable member cavity **28** and size to closely surround and/or engage retractable member **24** in such a manner that retractable member **24** may move axially with respect to retractable member housing **20**, and yet debris, water and the like, may be resisted from penetrating the seal and entering the retractable member cavity **28** of retractable member housing **20**. In various embodiments a variety of seal mechanisms may be used, including but not limited to a flange, O-ring, lip seal, labyrinth seal, etc. In one embodiment, a tapered seal may be used such that as the retractable member **24** retracts axially into the retractable member housing **20**, any debris that is adhered to the retractable member may be effectively scraped off as it passes the edge of the seal **29** and into the retractable member housing **20**.

[0020] **Figures 2A-2L** illustrate respective views of a retractable member actuation system in accordance with various embodiments. A sole portion **200** may include a plurality of retractable member housings **220** that are coupled thereto. A fluid chamber **214** may be disposed on or within all or part of sole **200**. In various embodiments, a retractable member stud **222** may include a second end portion **223** adapted to couple to a retractable member **224**, such that movement of the stud **222** may cause axial movement of the retractable member **224**. The retractable member **224** may be sized to axially move within retractable member cavity **228** of retractable member housing **220**. Stud **222** may have a first portion **221** that helps align the stud **222** within and stud cavity **231** and further helps minimize side to side movement within the cavity **231**. First portion **221** may also help form a seal with a stud cavity **231** of retractable member housing **220**, such that fluid may be kept from entering the stud cavity **231** or otherwise getting between the first stud portion **221** and the stud and retractable member stop

226. In various embodiments, the first stud portion **221** may include an o-ring seal seat **260** and an o-ring **262** to provide the sealing mechanism.

[0021] The retractable member stud **222** may have a body portion **225** that in various embodiments may be of a variety of configurations to help resist rotational movement when engaged with a correspondingly shaped stud aperture **227** in the stop **226**. The upper portion of the first stud portion **221** may be exposed to the fluid chamber **214**. Thus, as the pressure is increased in the fluid chamber **214** the retractable member stud **222** may be forced to move axially outward, thereby causing the retractable member **224** to extend axially outward from the retractable member housing **220**. In various embodiments a seal **229** may be coupled to the end of the retractable member housing **220** so as to help resist infiltration of debris into the retractable member housing cavity **228**.

[0022] In various embodiments, fluid within the fluid chamber **214** may be used to move the retractable member stud **222** and thus drive retractable member **224** axially with respect to the retractable member housing **220**. In various embodiments, the axial movement of the retractable member **224** may be limited to the distance equal to or less than the height of stud cavity **231**. In various embodiments, the distance of axial movement of the stud **222** is illustrated by distance **233**.

[0023] To cause actuation of the retractable members, fluid chamber **214** may be disposed under portions of the foot that experience the primary downward forces when the wearer is walking, running or moving in general. In various embodiments, such locations may include the heel area **237**, the ball of the foot area **239**, and/or the area along the outside of the foot, generally opposite the arch. So position, as the footwear user steps on one of these designated pressure areas, a flexible upper portion **240** of the fluid chamber **214** may depress, thus forcing the fluid in the fluid chamber **214** to act on the upper stud portion **221**, thereby causing the stud **222** to move into the stud cavity **231**. Such movement will drive the attached retractable member **224** to move axially outward of the retractable member housing **220**. In various embodiments, the outward extension of the retractable

members may be limited by the upper stud portion **221** engaging stop **226**. Likewise, the inward movement of the retractable members **224** may be limited by the retractable member **224** engaging the stop **226**.

[0024] In various embodiments, the fluid chamber **214** may be disposed directly over the top surfaces of the upper stud portions, such as in the case where the retractable members **224** generally directly underlie the heel force region. In various embodiments where the retractable members **224** may be somewhat offset from the general foot force region, such as the ball of the foot, channeling **216** may be employed to direct the fluid from the fluid chamber **214** to the first stud portions **221** in order to cause axial movement of the offset studs **222** and corresponding retractable members **224**. In various embodiments, a combination of direct overlie and channeling may be used.

[0025] In one embodiment, as the wearer is running, for example, as the wearer first steps on the heel, fluid will be forced from the heel fluid chamber thereby forcing the retractable members under the heel to move axially out of the retractable member housing. Where the retractable members are cleats, for example, this may help improve traction generally at the moment when the traction is needed most. As the wearer rocks towards the ball of the foot and applies pressure to the forward fluid chamber, the force on the forward fluid chamber will cause displacement of the studs and force axial movement of the retractable members at the forward portion of the footwear. In the cleat example, as illustrated, this again may cause extension of the cleats at the time that traction may be needed the most.

[0026] In various embodiments, the retractable member actuation system may be configured by having the chamber upper portion **240** couple to a sole first part **210** (e.g. upper or inner sole), thereby forming a part of the fluid chamber **214**. A lower sole portion **211** having a partial recess **213** dimensionally similar to the upper portion **240** of the fluid chamber may be bonded to the upper sole portion **210**, thereby forming the fluid chamber **214**. In various embodiments, the lower sole portion may carry the retractable member housings **220**.

[0027] In various embodiments, the flexible upper portion **240** of the fluid chamber **214** may be made of a resilient material that will tend to move back to a home undepressed position as the force is removed, thereby helping to urge the studs **222** to move in the reverse axial direction and urge retraction of the retractable members **224** back into the retractable member housing **220**. In various embodiments, biasing members may be disposed in the fluid chamber **214** to increase resistance to fluid chamber deformation, where the forces applied are particularly high (e.g. heavier person or highly mobile sport), as well as help urge movement of the flexible upper portion **240** to its home position. In various embodiments, a biasing member may be disposed in the stud cavity to help accomplish the same effects. Biasing members may include elastomers, springs, or other resilient members. In one embodiment, a honeycomb structure may be disposed in the fluid chamber.

[0028] In various embodiments, the fluid chamber of a designated pressure region, for example the heel region, may be coupled to the retractable members in a different region of the sole, such as the toe area, via channels. Thus, when pressure is exerted on the fluid chamber in the particular pressure zone, the retractable members in a different portion of the footwear sole will extend. This may generally be referred to an opposite drive effect. In various embodiments, this may allow the wearer to extend the forward retractable members by pressing down on ones heel. Once extended, the retractable members may be locked in the extended position. To lock the retractable members in place, a valve closure system may be used to prevent fluid from flowing back to the fluid chamber when the force is released. Likewise a valve may be used to lock the retractable members in a retracted position or any position between fully retracted and fully extended. In various embodiments, a mechanical locking system may be used to lock the retractable members in place.

[0029] **Figures 3A-3L** illustrate various views of a retractable member actuation system in accordance with various embodiments. Illustrating a similar actuation system as that described with respect to the example

embodiment shown in **Figures 2A-2L**, **Figures 3A-3L** illustrates another embodiment of a retractable member design, such as a cleat for use in sports such as football, baseball and soccer. In various embodiments, the movable or retractable member is disposed on the outside of the retractable member housing, which may increase the strength of the retractable member.

[0030] In various embodiments, the retractable member may have a retractable member inner cavity **344** adapted to engage a protrusion **348** of retractable member housing **320** and move axially relative there to. A stud coupling member **350** may be disposed in retractable member inner cavity **344**, and adapted to couple to the stud second end portion **323**, such that axial movement of the stud **322** will cause axial movement of the retractable member **324** about retractable member housing protrusion **348**. Actuation of the stud **322** via movement from the fluid chamber **314** may cause the inner wall of the retractable member cavity **344** to generally slide along the outer portion of the retractable member housing protrusion **348**. Similarly, the outer portion of the stud coupling member **350** may slidingly engage the retractable member housing protrusion cavity **352**.

[0031] Retractable member configurations in accordance with such embodiments provides enhanced surface to surface engagement and therefore improves support for the retractable member. This may enhance the strength and ability to withstand laterally directed forces. Further, in such embodiments, the double engagement of the retractable member with the housing protrusion may also provide two retractable member seals **329** and **329'**, which may improve the resistance of infiltration of debris into the actuation system. In various embodiments, the amount of engagement between the retractable member and the retractable member housing protrusion can vary to increase or decrease support or increase or decrease resistance to movement there between.

[0032] **Figures 4A-4G** illustrate a retractable member actuation system in accordance with the various embodiments. The footwear may have an external or partially external fluid reservoir **415** disposed in a region

of the footwear which does not typically encounter force during walking, running or other typical movements. In various embodiments, the external fluid reservoir **415** may be disposed in the arch region of the footwear. The fluid reservoir **415** may be coupled to a retractable member driver systems (e.g. diaphragm system of Figures 1 or sealed stud system of figures 2 and 3) via channels **416**. To actuate the retractable members, an external reservoir actuator **460** may force fluid from the external fluid reservoir **415** into the actuation system fluid chambers **414** disposed about the retractable member actuators **422** (e.g. studs) to actuate the retractable members **424**.

[0033] In various embodiments, the external fluid actuator **460** may be, for example, a strap that when tightened drives the fluid in the retractable member actuation system (as illustrated). In various embodiments, the external fluid actuator may be a zipper that when zipped compresses the external fluid reservoir and forces the fluid into the retractable member actuation system. In various embodiments, other drivers may be used.

[0034] In various embodiments, the retractable members **424**, when actuated, may be generally held in the extended position by ensuring the external fluid reservoir actuator is held in position where the external reservoir **415** remains compressed. In various embodiments, the locking of the retractable members in either the extended or retracted position may be enhanced by actuating a valve **470** such that the fluid may be prevented from flowing back into or out of the external fluid reservoir **415**.

[0035] To retract the retractable members **424**, the pressure on the exterior fluid reservoir **415** may be released. The retractable members may be retracted by resiliency in the actuation mechanisms, examples of which were described above, and/or via pressure exerted by the user on the retractable members **424**.

[0036] The term “fluid” used herein is used in the broadest sense, and includes, but is not limited to, liquids, such as hydraulic fluids and self sealing liquids, and gasses, such as air.

[0037] Although certain embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art

that a wide variety of alternate and/or equivalent embodiments or implementations calculated to achieve the same purposes may be substituted for the embodiments shown and described without departing from the scope of the present invention. Those with skill in the art will readily appreciate that embodiments in accordance with the present invention may be implemented in a very wide variety of ways. This application is intended to cover any adaptations or variations of the embodiments discussed herein. Therefore, it is manifestly intended that embodiments in accordance with the present invention be limited only by the claims and the equivalents thereof.

Claim

I claim:

1. An article of footwear, comprising:
A plurality of retractable members configured to move relative to a bottom portion of the footwear; and
A control system coupled to the retractable members configured to extend and retract the retractable members relative to the bottom portion of the foot wear.

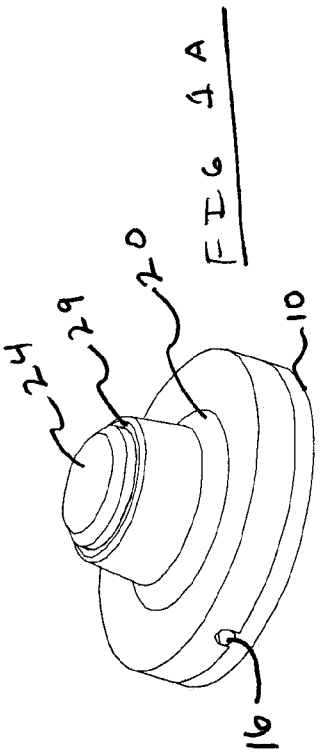

24
29
20
10
16

FIG 1A

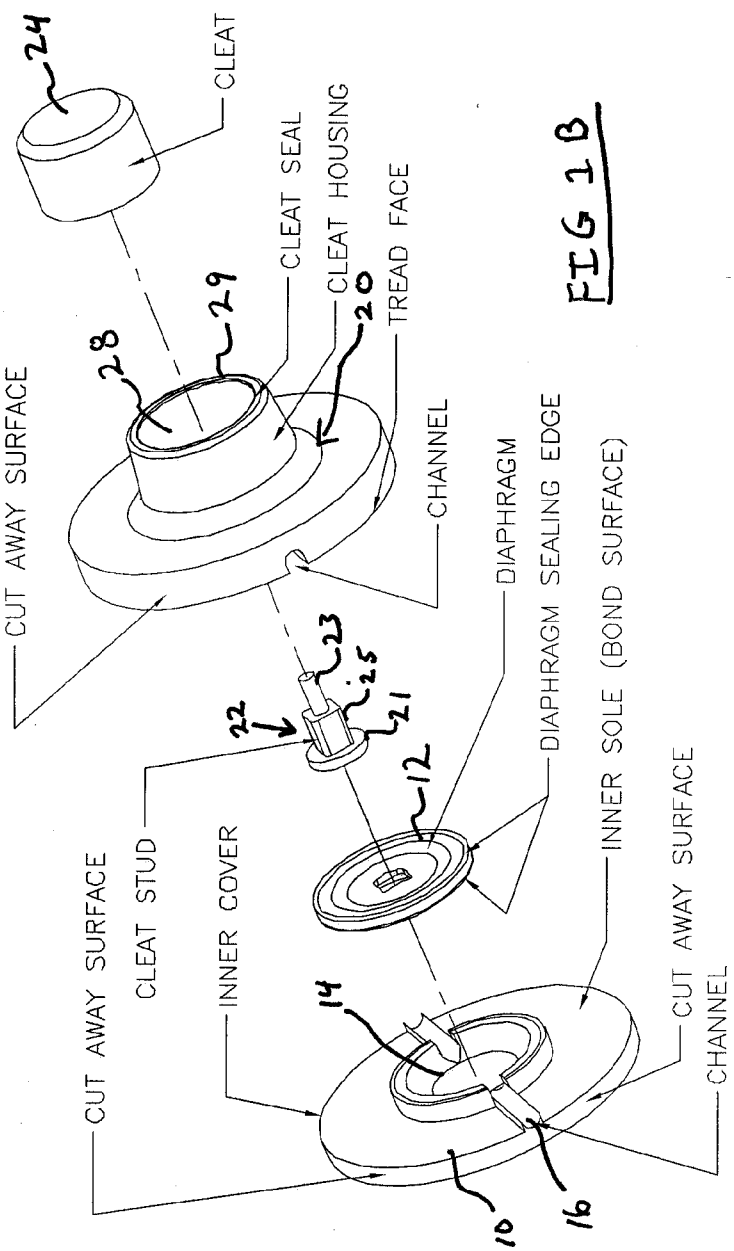

24
CLEAT
CLEAT SEAL
CLEAT HOUSING
TREAD FACE
29
28
20
CUT AWAY SURFACE
CHANNEL
DIAPHRAGM
DIAPHRAGM SEALING EDGE
INNER SOLE (BOND SURFACE)
23
25
22
21
12
CLEAT STUD
INNER COVER
CUT AWAY SURFACE
14
CUT AWAY SURFACE
CHANNEL
10
16

FIG 1B

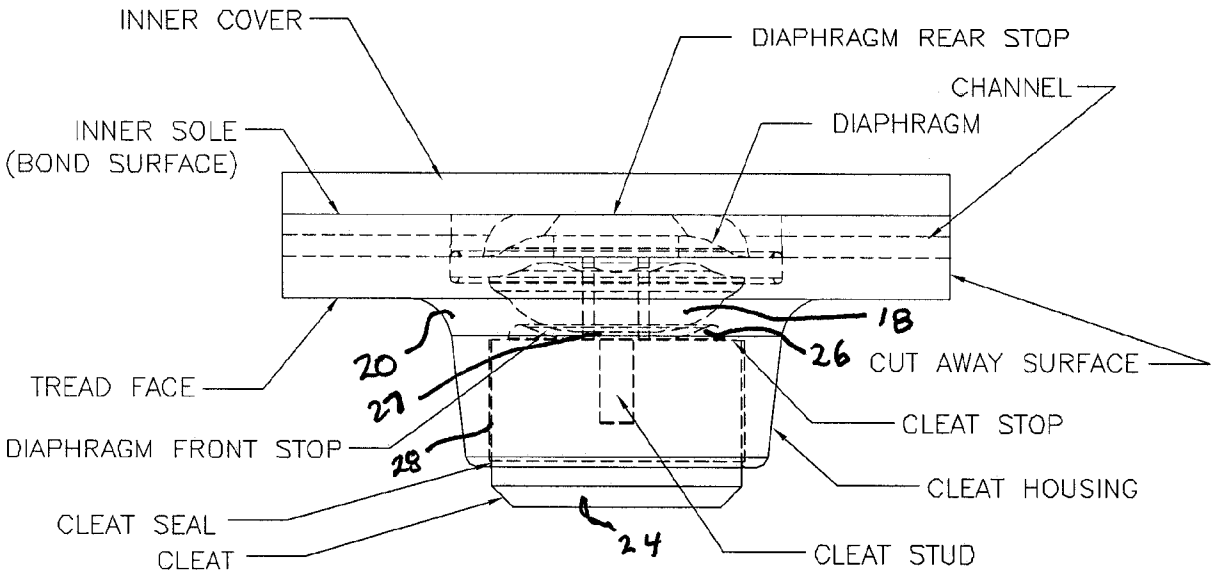

INNER COVER
DIAPHRAGM REAR STOP
CHANNEL
INNER SOLE
(BOND SURFACE)
DIAPHRAGM
18
20
26
CUT AWAY SURFACE
TREAD FACE
27
CLEAT STOP
DIAPHRAGM FRONT STOP
28
CLEAT HOUSING
CLEAT SEAL
CLEAT
24
CLEAT STUD

FIG 1D

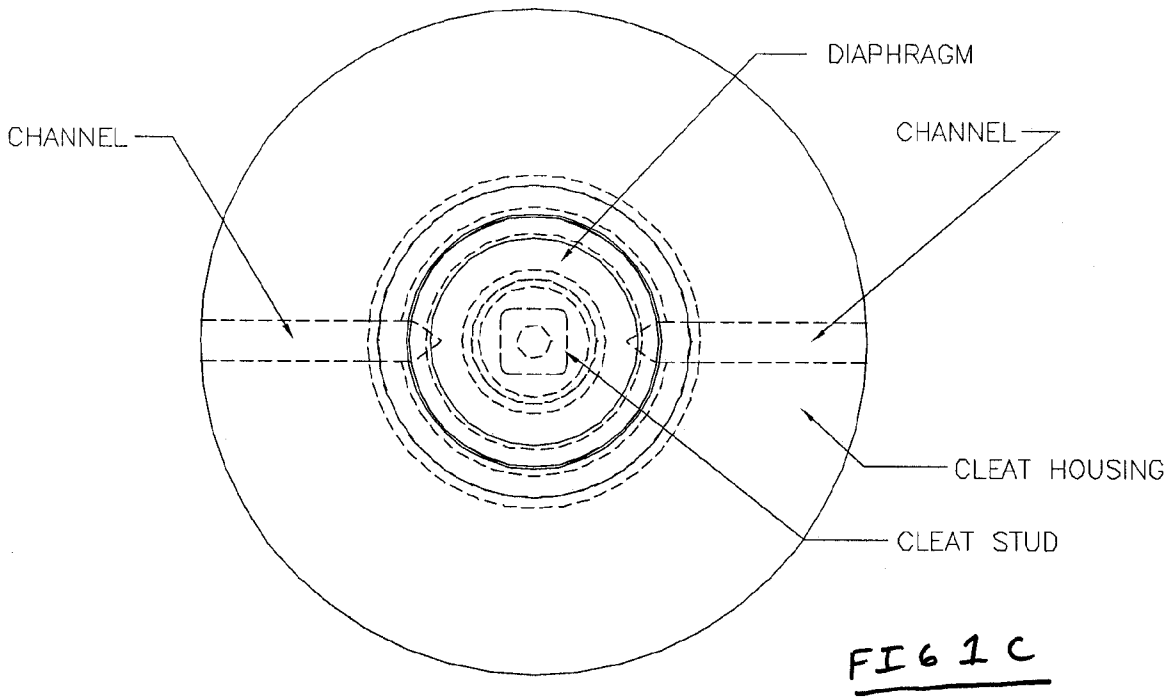

DIAPHRAGM
CHANNEL
CHANNEL
CLEAT HOUSING
CLEAT STUD

FIG 1C

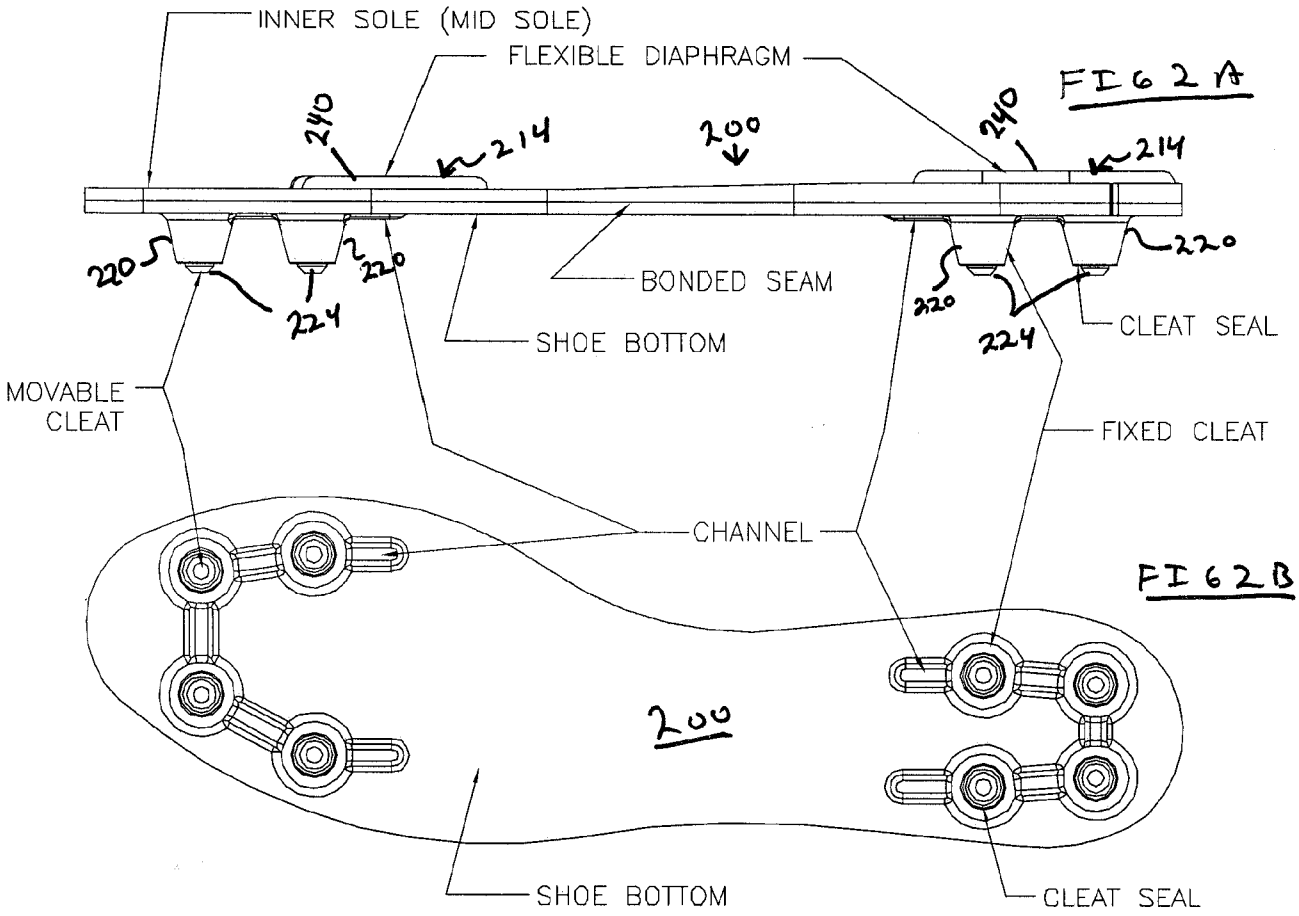


FIG 2A

FIG 2B

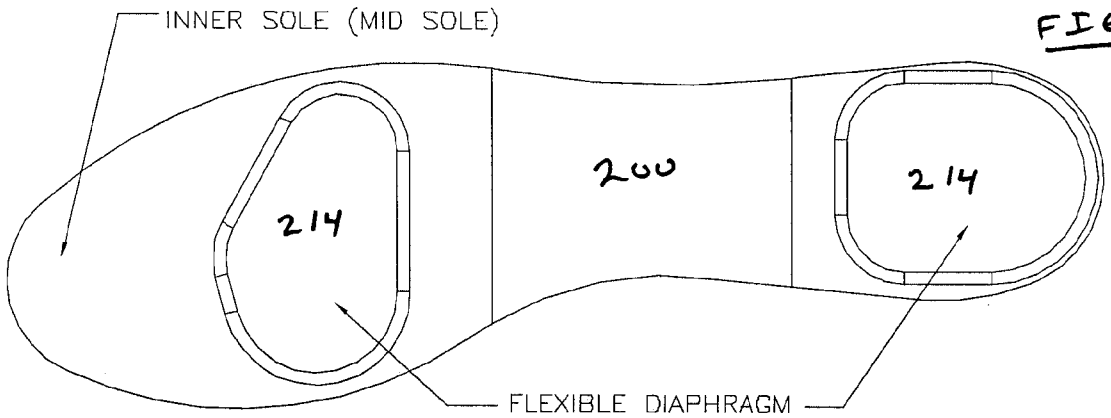


FIG 2C

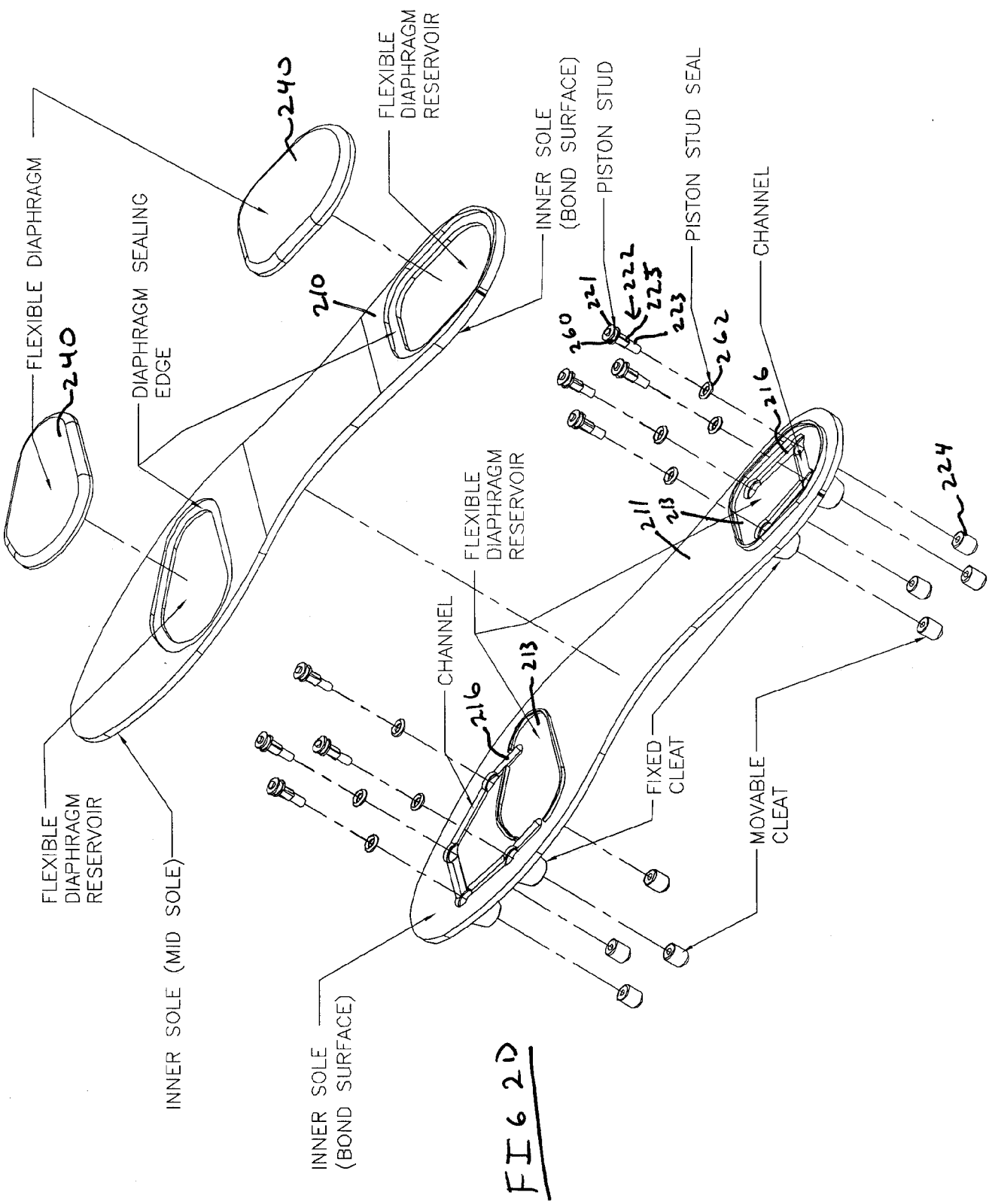

FLEXIBLE DIAPHRAGM
240
DIAPHRAGM SEALING EDGE
FLEXIBLE DIAPHRAGM RESERVOIR
243
210
INNER SOLE (BOND SURFACE)
PISTON STUD
PISTON STUD SEAL
CHANNEL
260
221
222
223
262
216
211
213
224
FLEXIBLE DIAPHRAGM RESERVOIR
CHANNEL
216
213
FIXED CLEAT
MOVABLE CLEAT
FLEXIBLE DIAPHRAGM RESERVOIR
INNER SOLE (MID SOLE)
INNER SOLE (BOND SURFACE)

FIG 2D

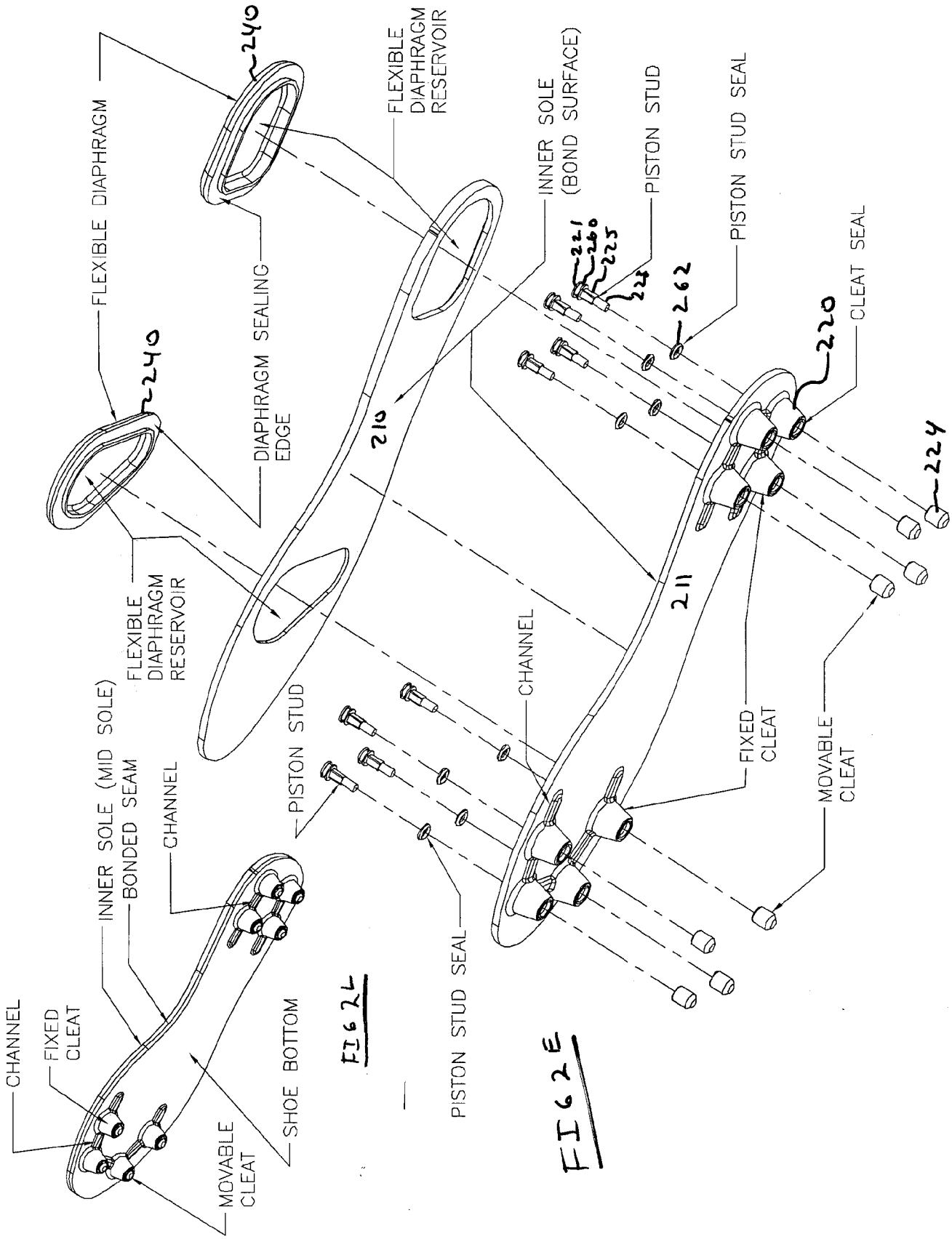

FLEXIBLE DIAPHRAGM
240
DIAPHRAGM SEALING EDGE
FLEXIBLE DIAPHRAGM RESERVOIR
INNER SOLE (MID SOLE)
BONDED SEAM
CHANNEL
PISTON STUD
210
INNER SOLE (BOND SURFACE)
221
260
225
PISTON STUD
262
PISTON STUD SEAL
220
CLEAT SEAL
224
211
CHANNEL
FIXED CLEAT
MOVABLE CLEAT
PISTON STUD SEAL
CHANNEL
FIXED CLEAT
SHOE BOTTOM
MOVABLE CLEAT

FIG 2E

FIG 2F

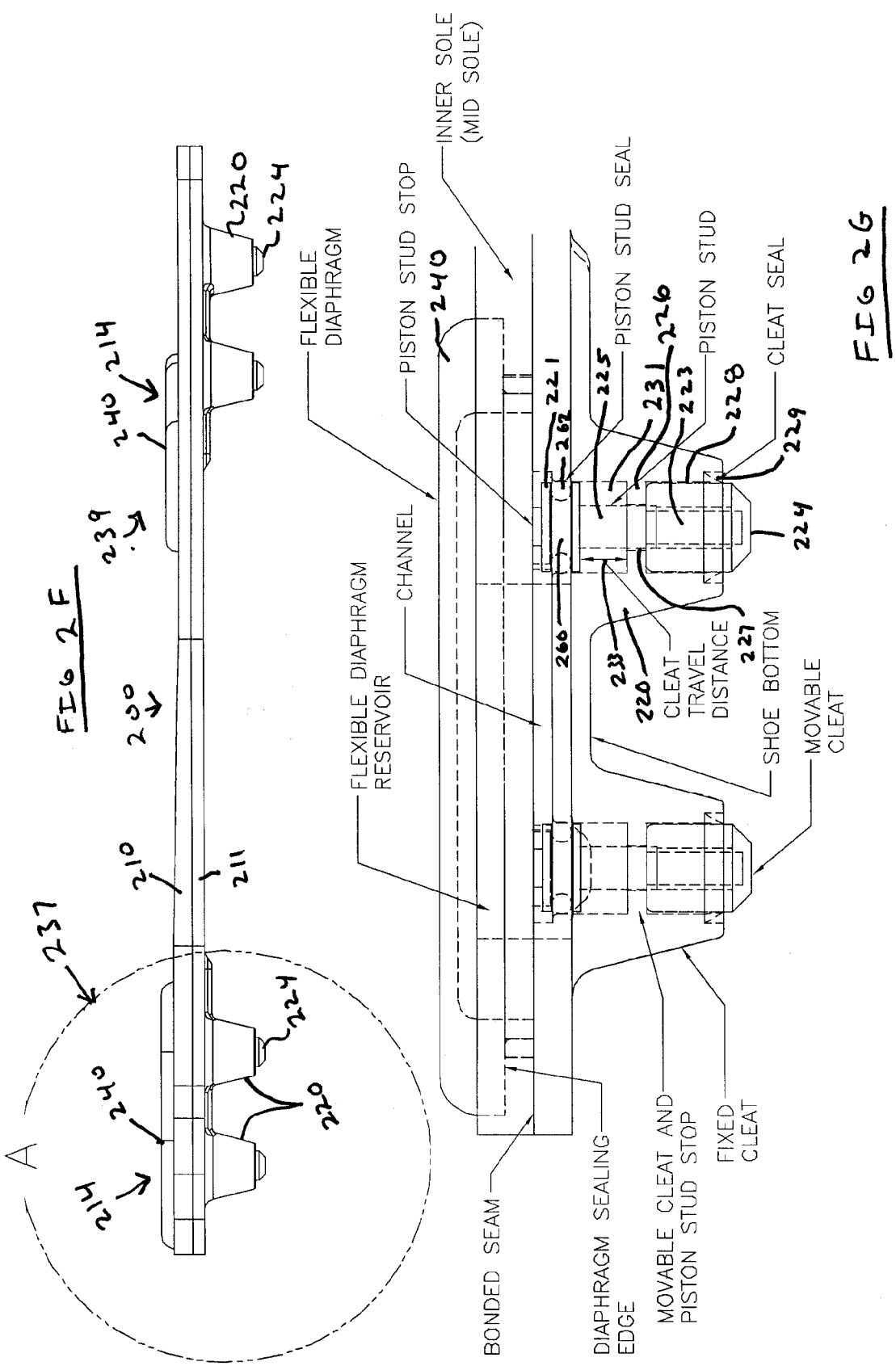


FIG 2F
FIG 2G
A
237
210
211
200
239
214
240
220
224
FLEXIBLE DIAPHRAGM
PISTON STUD STOP
INNER SOLE (MID SOLE)
PISTON STUD SEAL
PISTON STUD
CLEAT SEAL
CHANNEL
FLEXIBLE DIAPHRAGM RESERVOIR
CLEAT TRAVEL DISTANCE
SHOE BOTTOM
MOVABLE CLEAT
BONDED SEAM
DIAPHRAGM SEALING EDGE
MOVABLE CLEAT AND PISTON STUD STOP
FIXED CLEAT

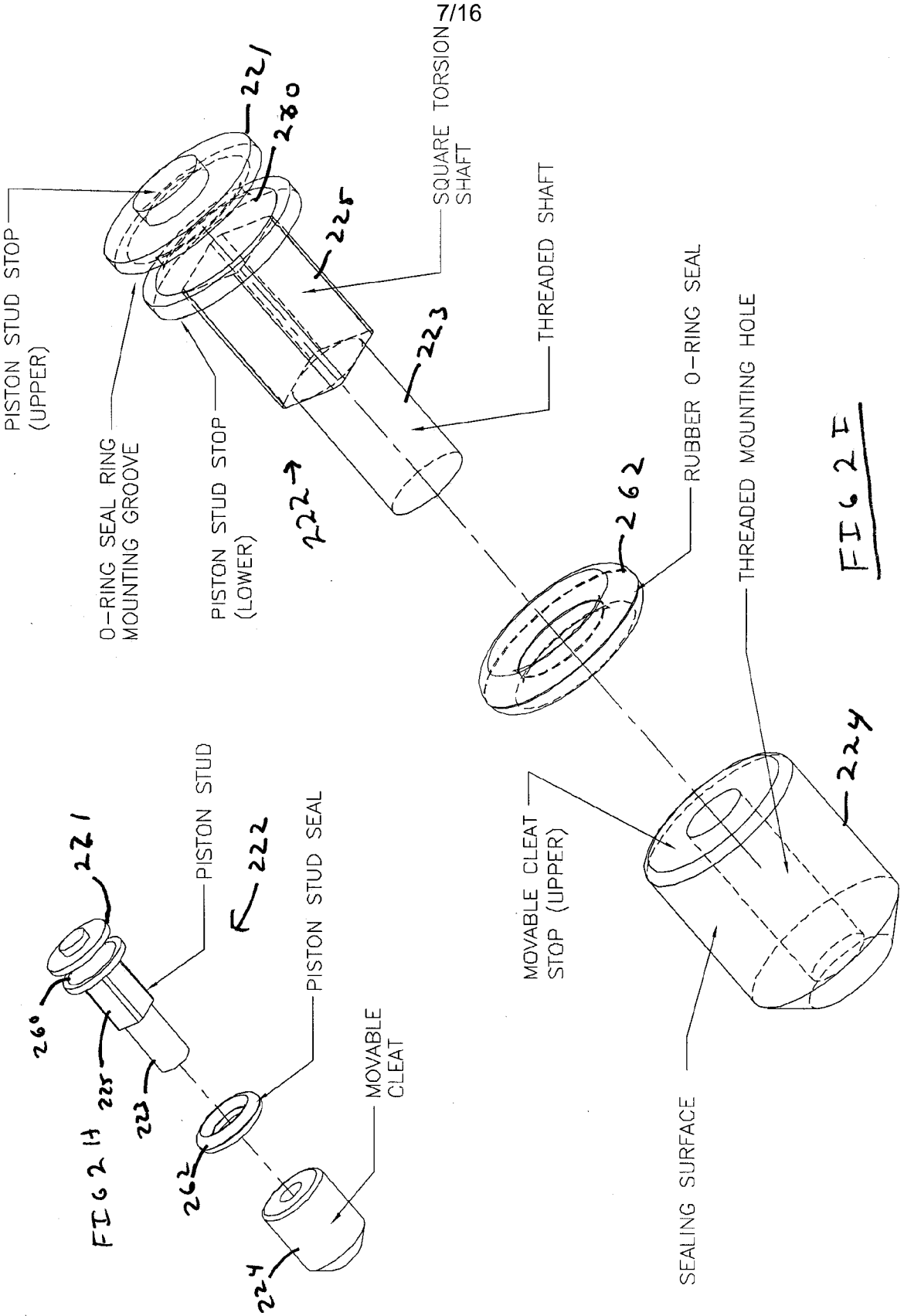

PISTON STUD STOP (UPPER)
O-RING SEAL RING MOUNTING GROOVE
PISTON STUD STOP (LOWER)
SQUARE TORSION SHAFT
THREADED SHAFT
RUBBER O-RING SEAL
THREADED MOUNTING HOLE
MOVABLE CLEAT STOP (UPPER)
SEALING SURFACE
221
230
225
223
222
262
224
PISTON STUD
PISTON STUD SEAL
MOVABLE CLEAT
260

FIG 2E

FIG 2H

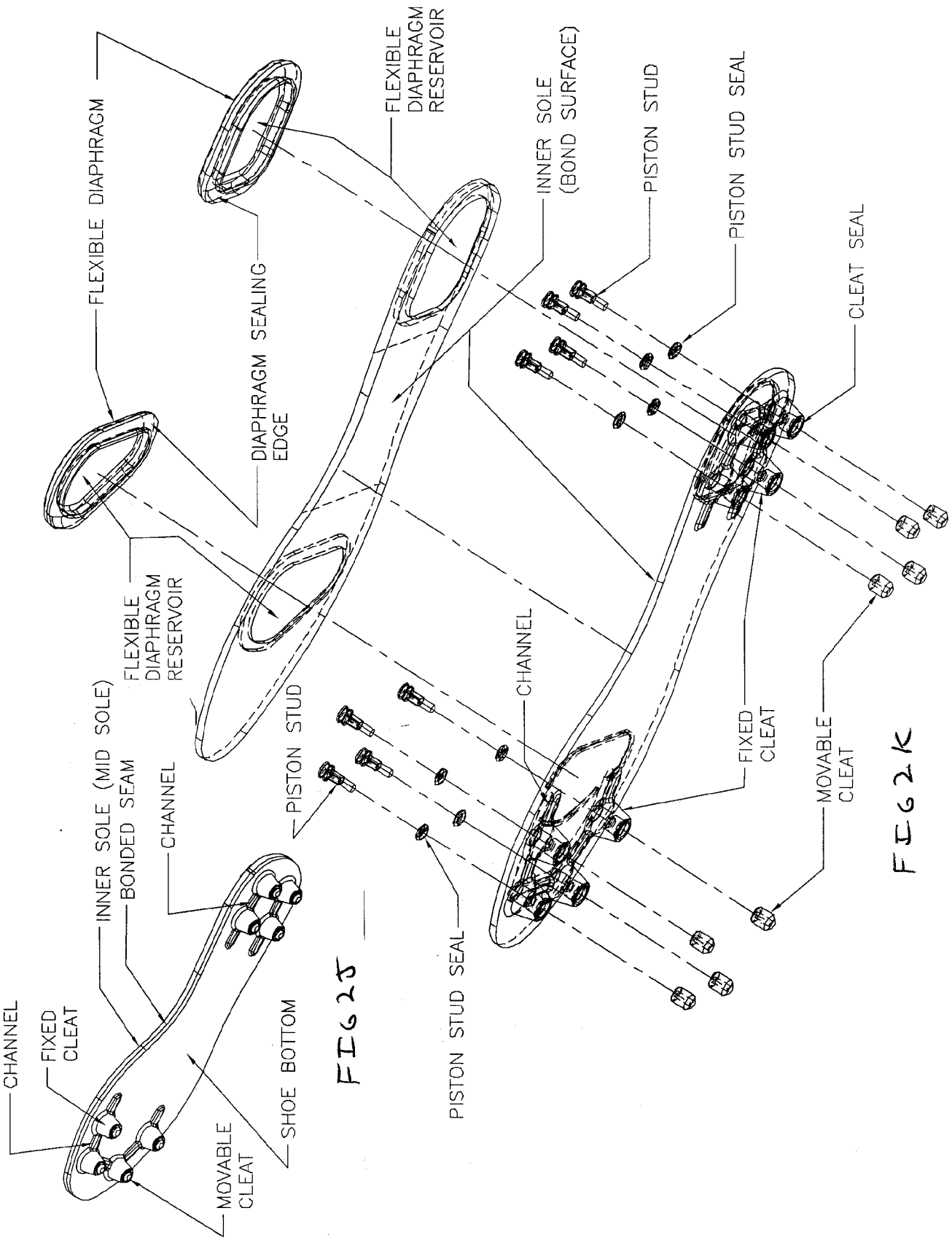

FLEXIBLE DIAPHRAGM
DIAPHRAGM SEALING EDGE
FLEXIBLE DIAPHRAGM RESERVOIR
INNER SOLE (BOND SURFACE)
PISTON STUD
PISTON STUD SEAL
CLEAT SEAL
FLEXIBLE DIAPHRAGM RESERVOIR
INNER SOLE (MID SOLE)
BONDED SEAM
CHANNEL
PISTON STUD
CHANNEL
FIXED CLEAT
MOVABLE CLEAT
CHANNEL
FIXED CLEAT
SHOE BOTTOM
MOVABLE CLEAT
PISTON STUD SEAL

FIG 2J

FIG 2K

FIG 3A

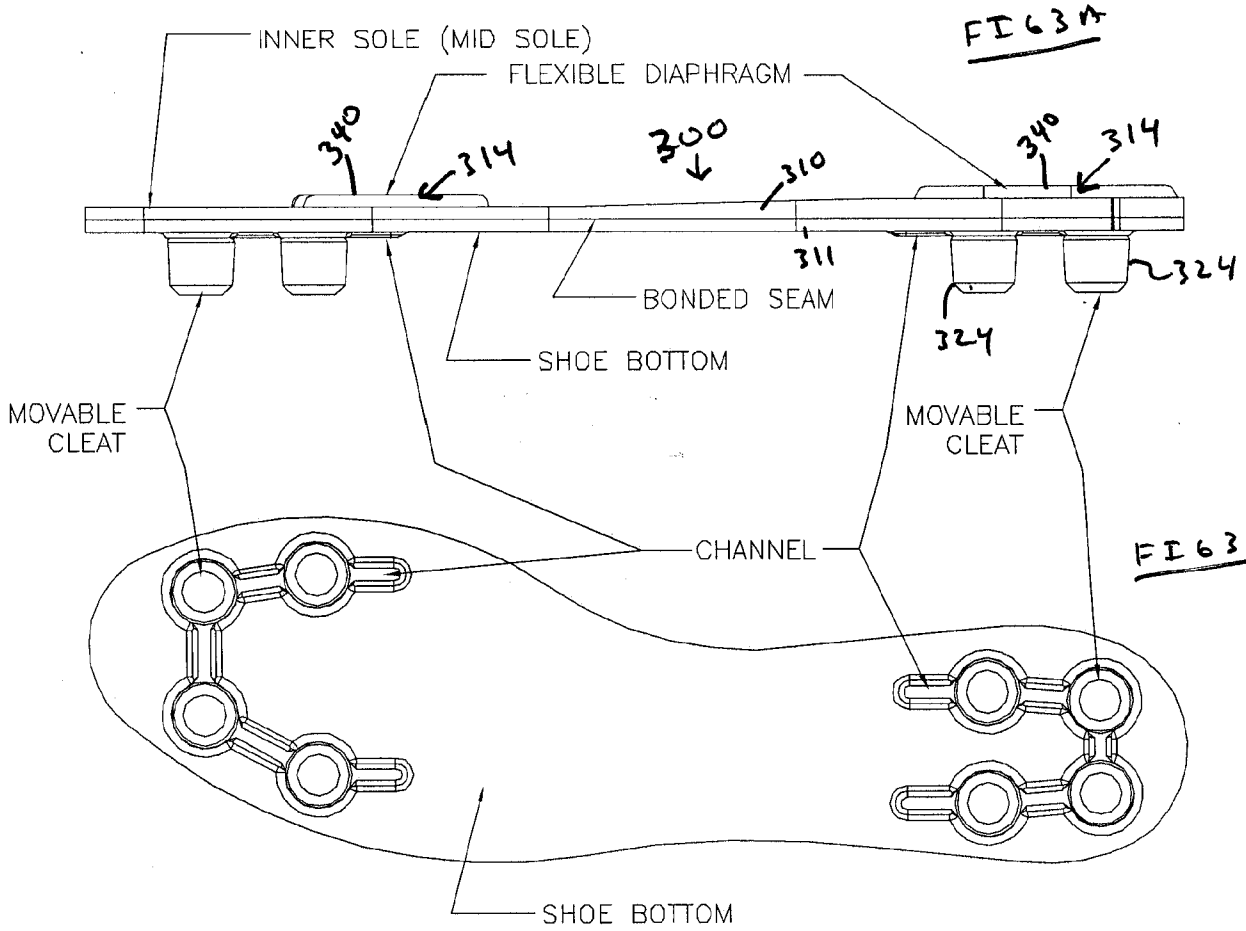
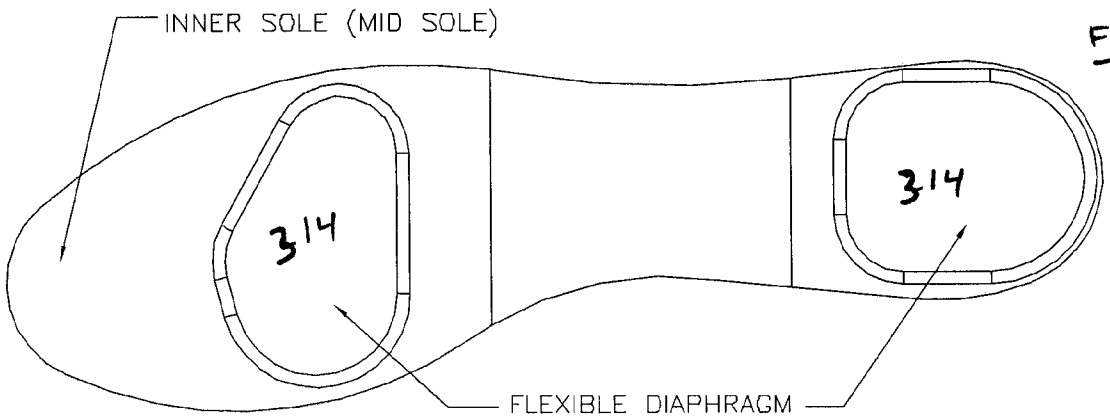


FIG 3B

FIG 3C



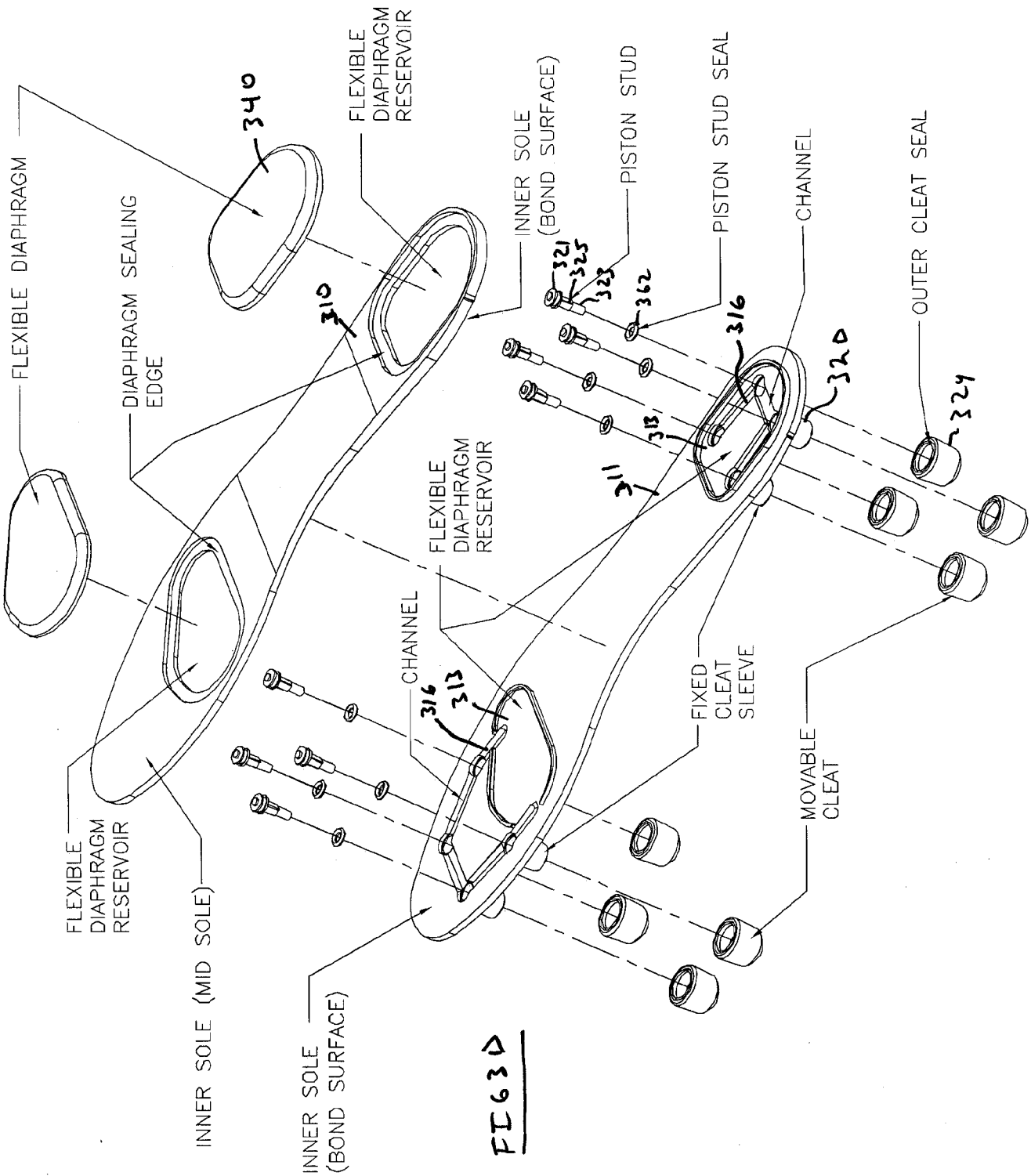

FLEXIBLE DIAPHRAGM
DIAPHRAGM SEALING EDGE
340
FLEXIBLE DIAPHRAGM RESERVOIR
310
INNER SOLE (BOND SURFACE)
321
325
323
PISTON STUD
362
PISTON STUD SEAL
316
CHANNEL
320
OUTER CLEAT SEAL
324
313
311
FLEXIBLE DIAPHRAGM RESERVOIR
CHANNEL
316
313
FIXED CLEAT SLEEVE
MOVABLE CLEAT
FLEXIBLE DIAPHRAGM RESERVOIR
INNER SOLE (MID SOLE)
INNER SOLE (BOND SURFACE)

FIG 3D

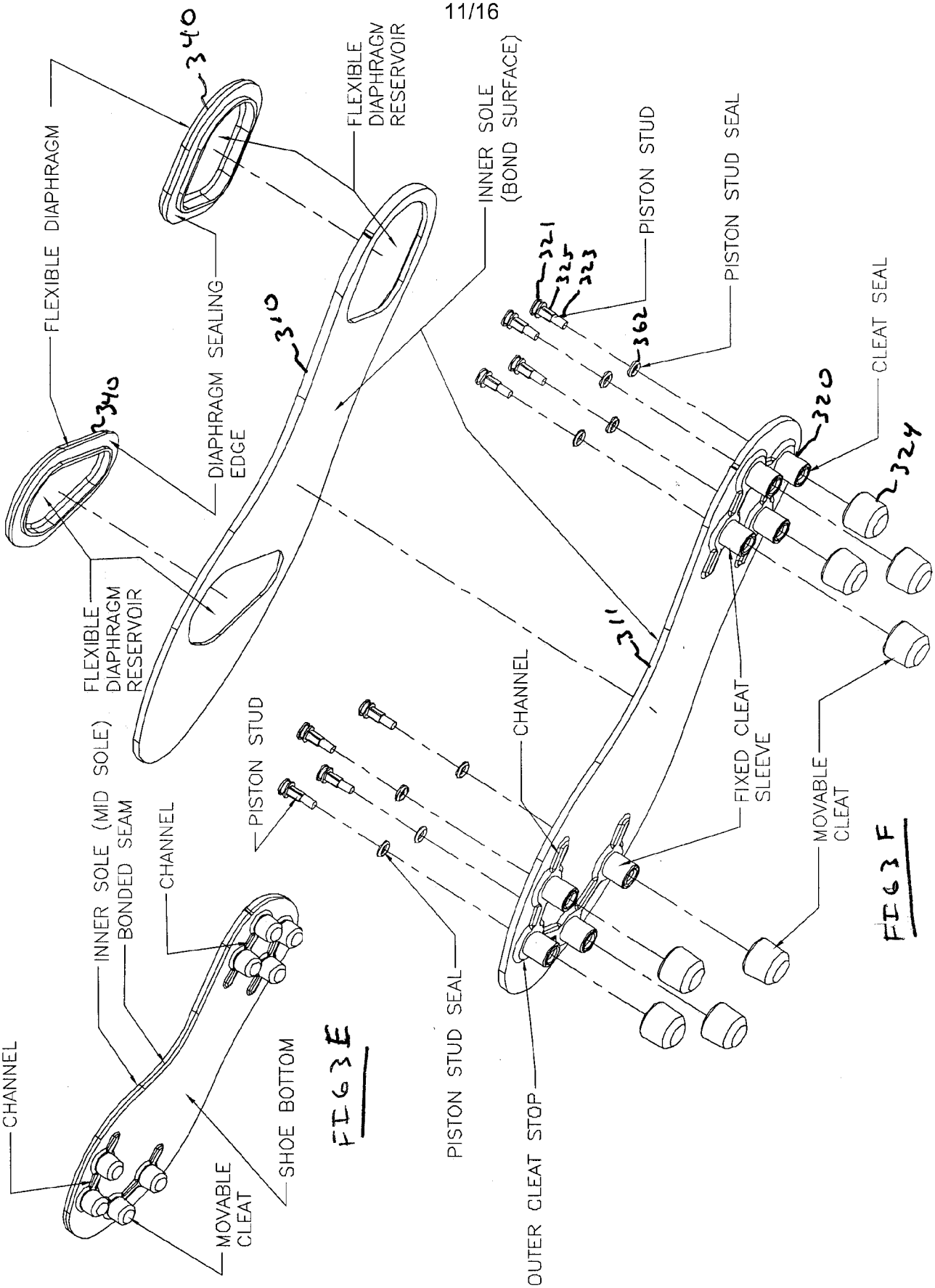

FLEXIBLE DIAPHRAGM
340
FLEXIBLE DIAPHRAGM RESERVOIR
DIAPHRAGM SEALING EDGE
310
INNER SOLE (BOND SURFACE)
321
325
323
PISTON STUD
PISTON STUD SEAL
362
320
CLEAT SEAL
324
FLEXIBLE DIAPHRAGM RESERVOIR
340
DIAPHRAGM SEALING EDGE
INNER SOLE (MID SOLE)
BONDED SEAM
CHANNEL
PISTON STUD
311
CHANNEL
FIXED CLEAT SLEEVE
MOVABLE CLEAT
CHANNEL
SHOE BOTTOM
MOVABLE CLEAT
PISTON STUD SEAL
OUTER CLEAT STOP

FIG 3E

FIG 3F

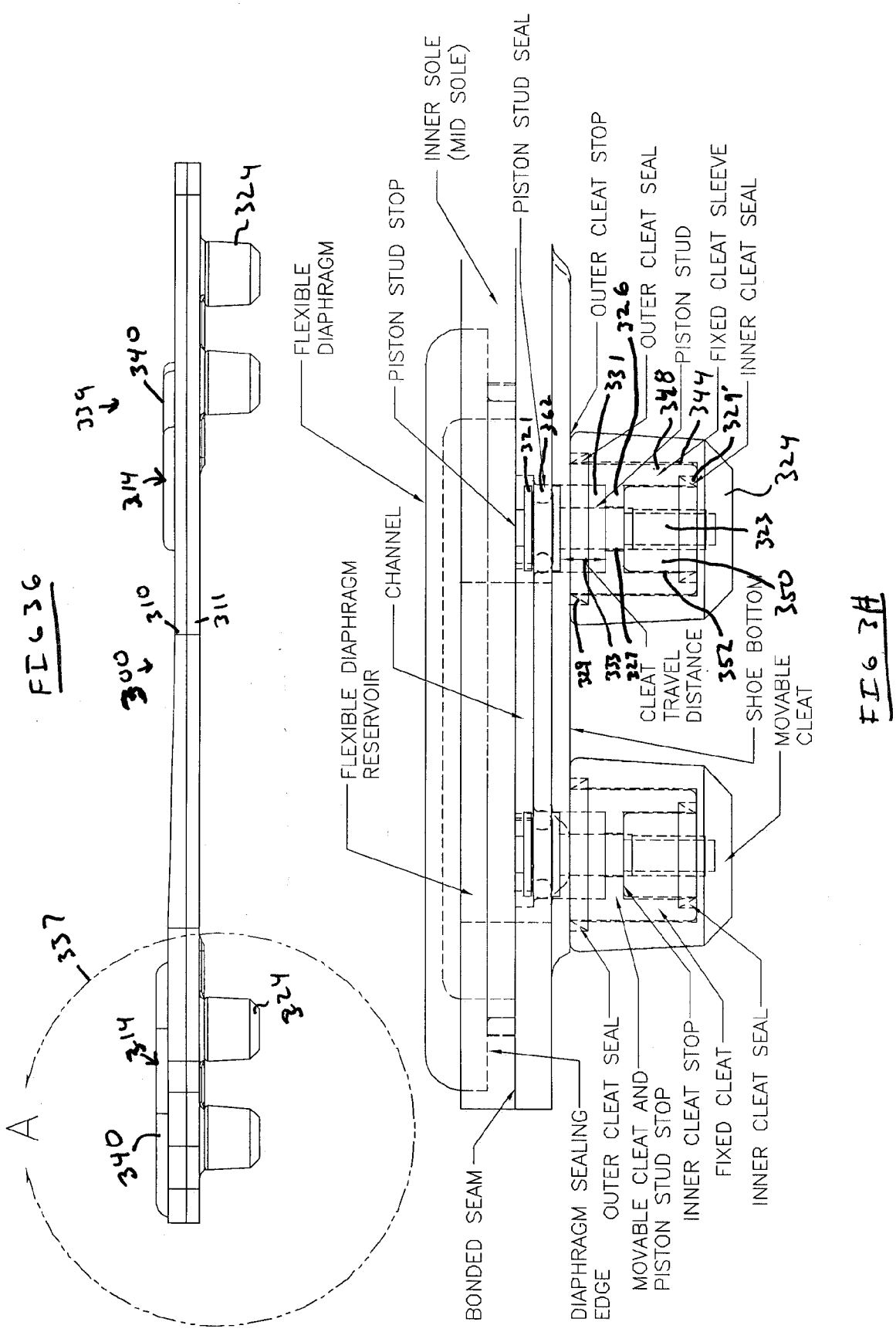


FIG 3G
FIG 3H
A
337
324
314
340
334
300
310
311
FLEXIBLE DIAPHRAGM
PISTON STUD STOP
INNER SOLE (MID SOLE)
PISTON STUD SEAL
OUTER CLEAT STOP
OUTER CLEAT SEAL
PISTON STUD
FIXED CLEAT SLEEVE
INNER CLEAT SEAL
CHANNEL
FLEXIBLE DIAPHRAGM RESERVOIR
SHOE BOTTOM
MOVABLE CLEAT
CLEAT TRAVEL DISTANCE
BONDED SEAM
DIAPHRAGM SEALING EDGE
OUTER CLEAT SEAL
MOVABLE CLEAT AND PISTON STUD STOP
INNER CLEAT STOP
FIXED CLEAT
INNER CLEAT SEAL
321
322
326
331
348
344
329
323
350
352
327
333
329

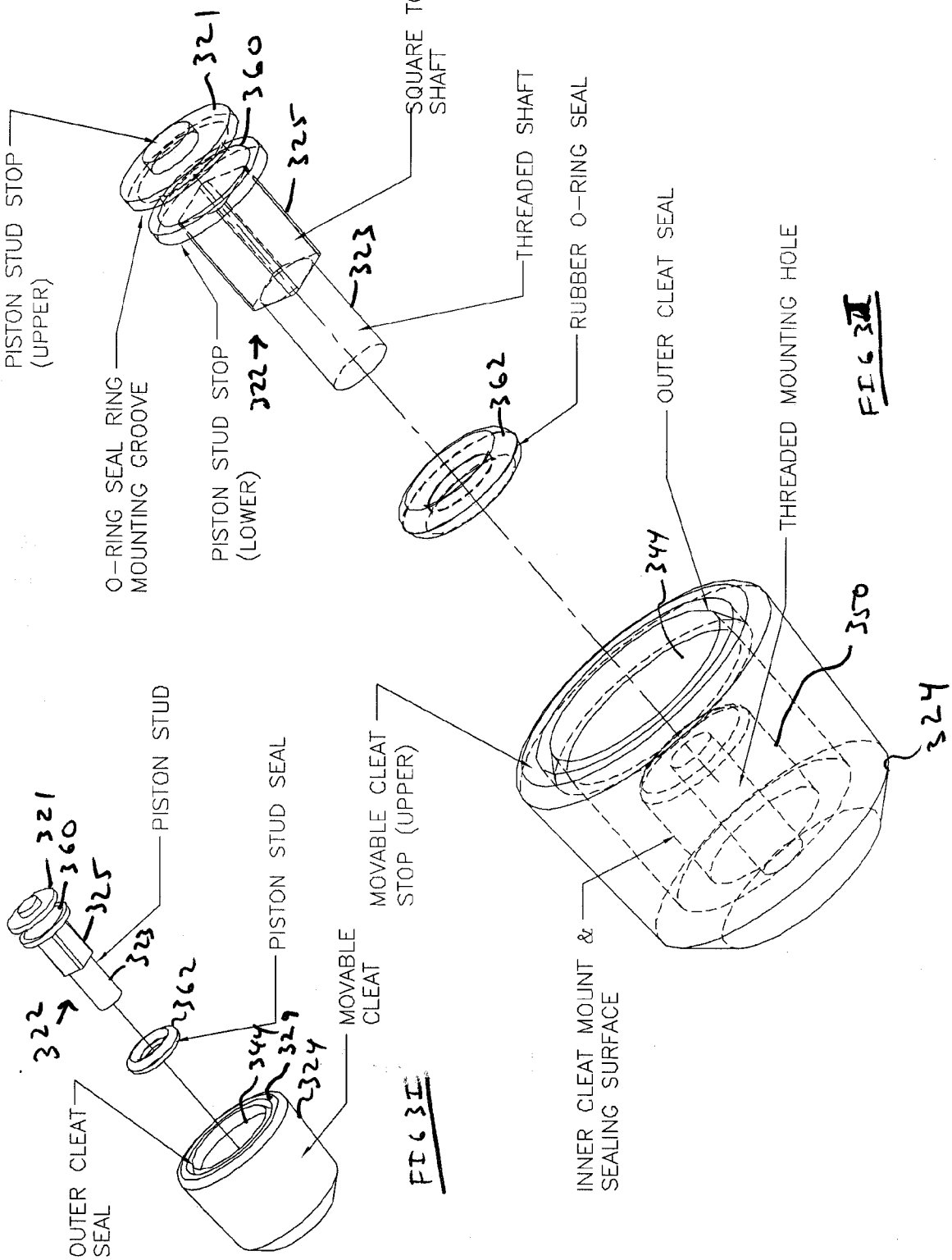
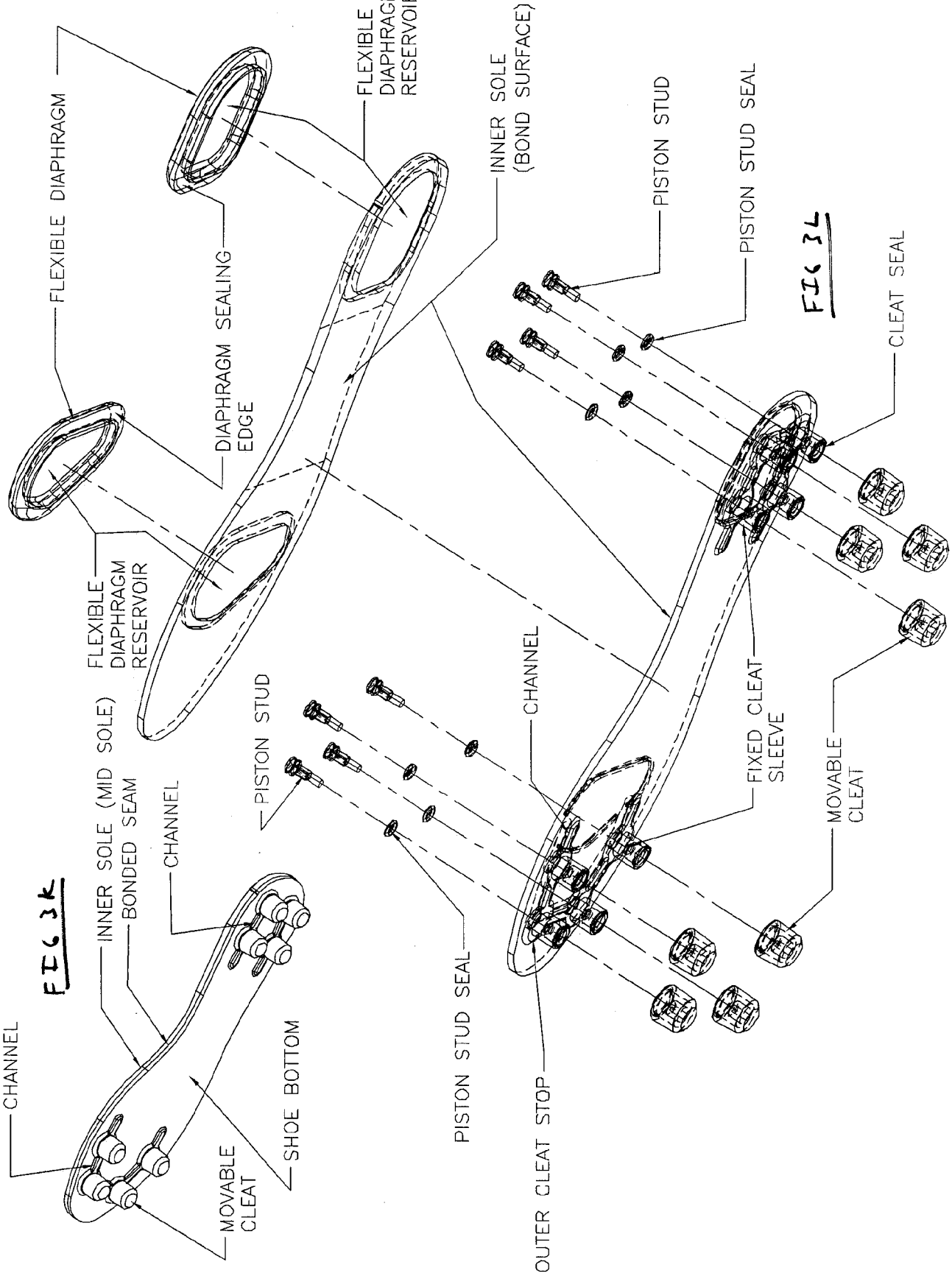


FIG 3I

FIG 3II


FLEXIBLE DIAPHRAGM
DIAPHRAGM SEALING EDGE
FLEXIBLE DIAPHRAGM RESERVOIR
FLEXIBLE DIAPHRAGM RESERVOIR
INNER SOLE (BOND SURFACE)
PISTON STUD
PISTON STUD SEAL
CLEAT SEAL
FIG 3J
FIG 3K
INNER SOLE (MID SOLE)
BONDED SEAM
CHANNEL
PISTON STUD
CHANNEL
FIXED CLEAT SLEEVE
MOVABLE CLEAT
CHANNEL
SHOE BOTTOM
MOVABLE CLEAT
PISTON STUD SEAL
OUTER CLEAT STOP

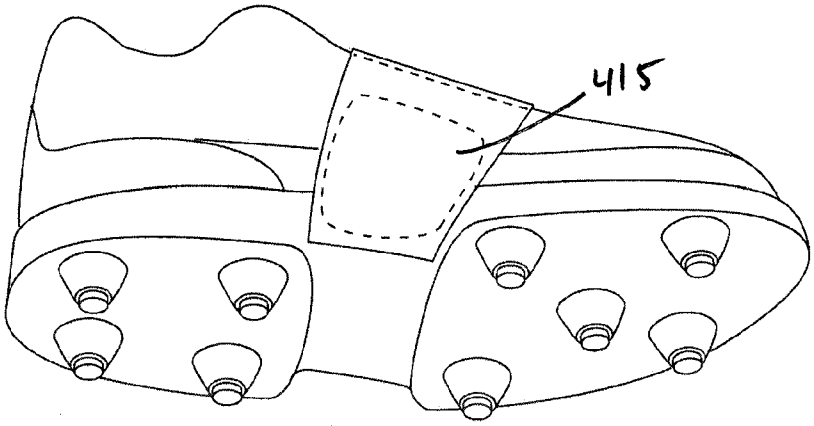


FIG 4A

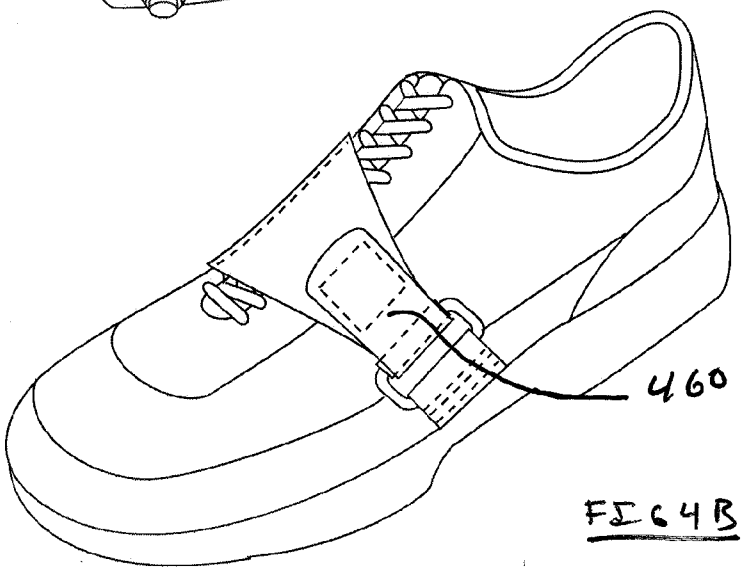


FIG 4B

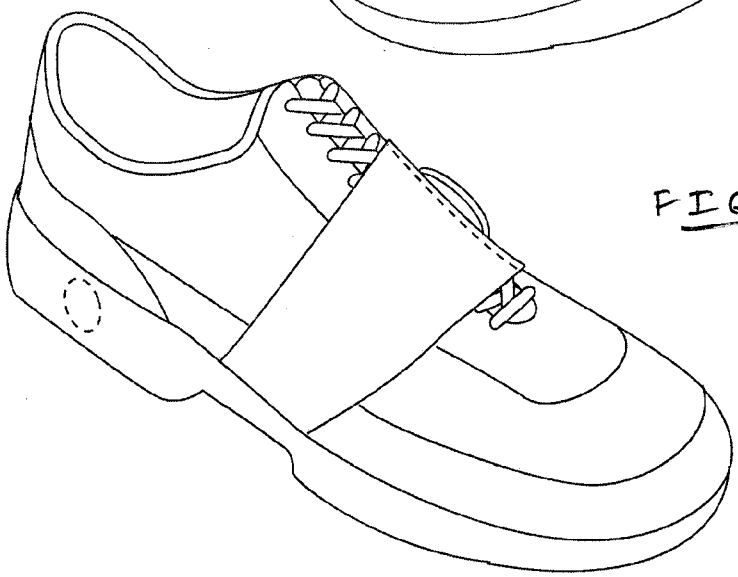


FIG 4C

FIG 4D

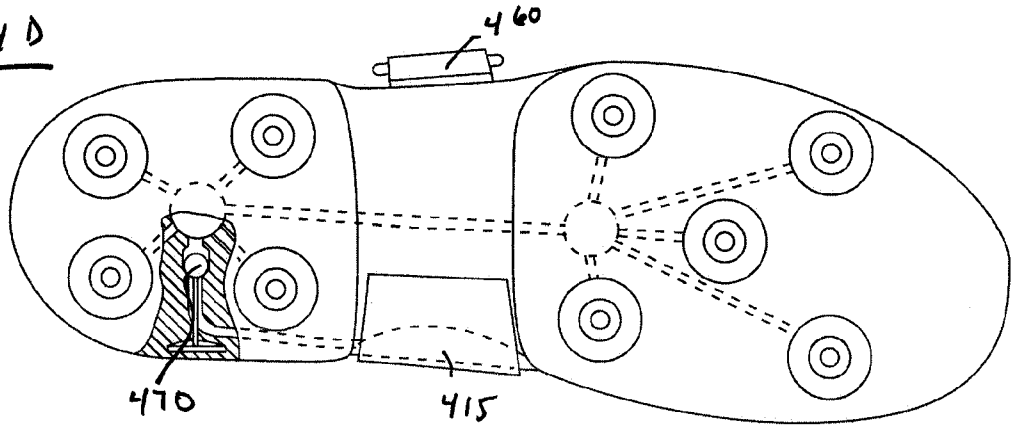


FIG 4E

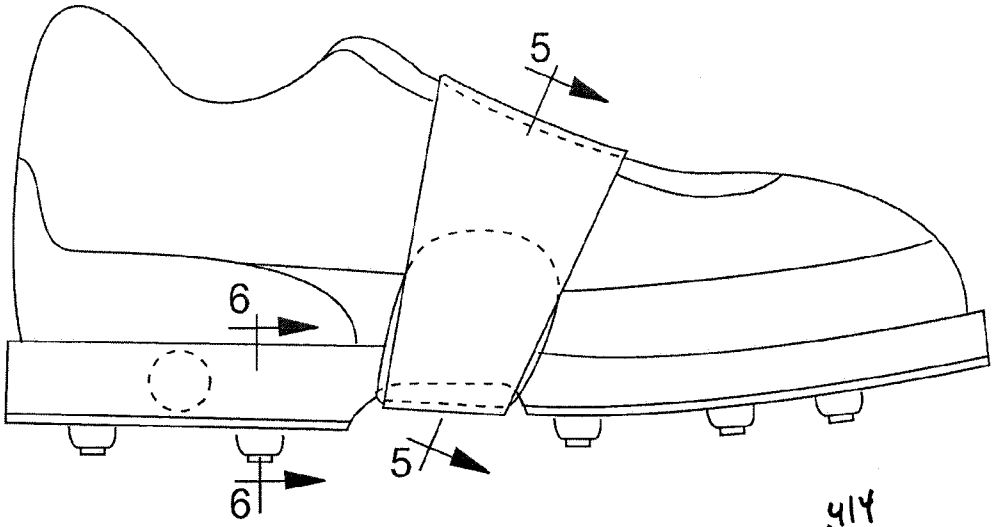


FIG 4F

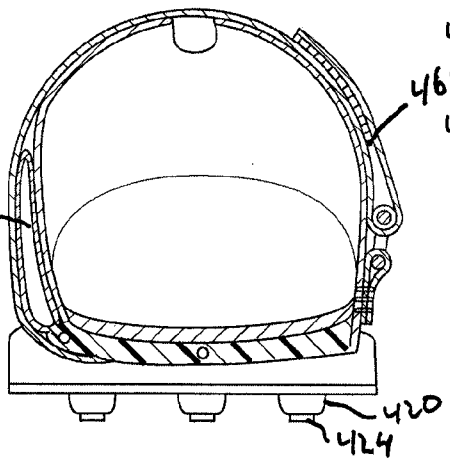


FIG 4G

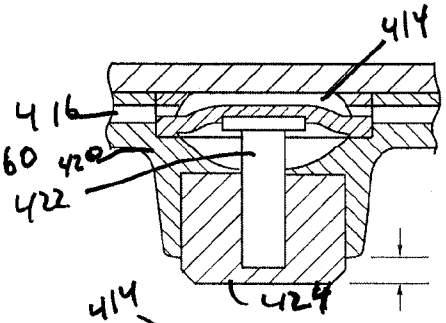


FIG 4H

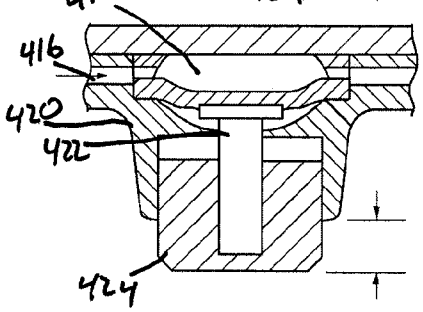


FIG. 5