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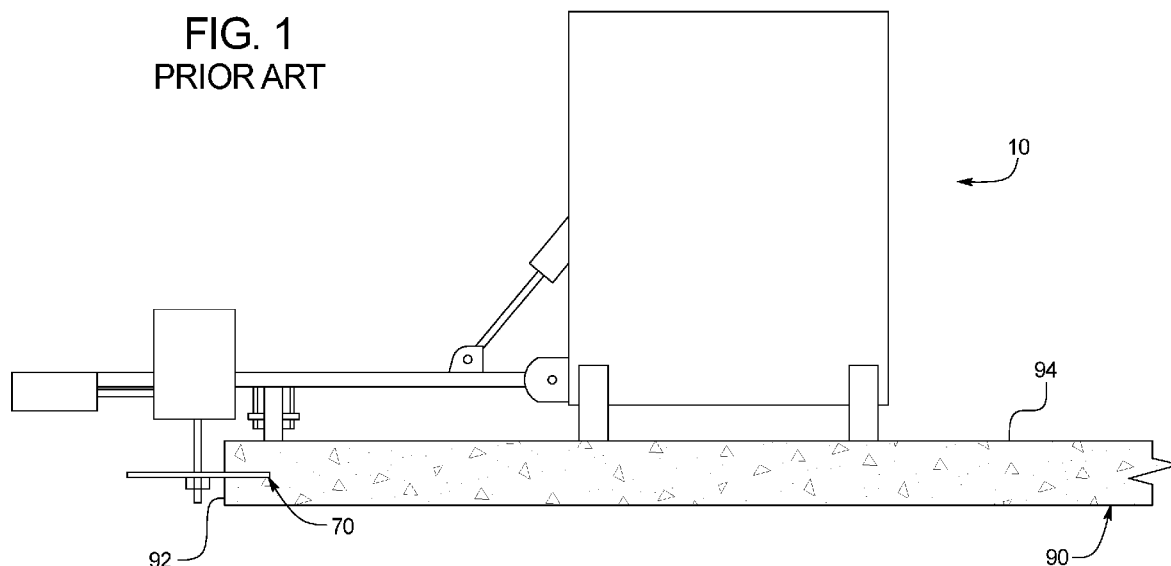
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(54) Title: LOAD TRANSFER PLATE AND METHOD OF EMPLOYING SAME

FIG. 1
PRIOR ART



(57) Abstract: A load transfer plate (100,1100,2100,3100) for transferring loads across a joint between a first or existing cast-in-place concrete slab (90) and a second or new cast-in-place concrete slab (96), comprising a non-symmetrically shaped body (110,1110,2110,3110) having a semi-cylindrical first portion (112,1112,2112,3112) configured to protrude into and be secured in the first cast-in-place concrete slab and a non-semi cylindrical second portion (114,1114,2114,3114) configured to protrude into a load transfer plate pocket (300) secured in the second cast-in-place concrete, a substantially planar upper surface (120,1120,2120,3120), and a substantially planar lower surface (130,1130,2130,3130). And a method for transferring loads across a joint between a first cast-in-place concrete slab and a second cast-in-place concrete slab.

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LOAD TRANSFER PLATE AND METHOD OF EMPLOYING SAME

PRIORITY

This application claims priority to and the benefit of U.S. Provisional Patent Application Serial No. 62/436,789, filed December 20, 2016, and U.S. Non-Provisional Patent Application No. 15/833,589, filed December 6, 2017 the entire contents of each
5 of which are incorporated herein by reference.

BACKGROUND

For various logistical and technical reasons, concrete floors are typically made up of a series of individual cast-in-place concrete blocks or slabs referred to herein as
10 "concrete slabs" or "slabs". These concrete slabs provide several advantages including relief of internal stress due to curing shrinkage and thermal movement. However, there are various known issues with such concrete slabs.

One issue with concrete floors occurs when one of the concrete slabs is damaged and needs to be replaced with a new concrete slab. The damaged concrete
15 slab must be removed, and a new concrete slab must be poured and hardened or cured to properly restore the concrete floor adjacent to the remaining existing concrete slab.

Another issue with concrete floors occurs when part of one of the concrete slabs is damaged and needs to be replaced. In such case, a vertically extending cut is made in the concrete slab to separate the damaged part of the concrete slab from the non-
20 damaged part of the concrete slab. The damaged part of the concrete slab is then removed. A new portion of that concrete slab is poured and hardened or cured to properly restore the concrete slab adjacent to the remaining existing, undamaged part of the concrete slab.

In both of these situations, the new concrete slab is positioned adjacent to one or
25 more other existing concrete slabs or preserved non-damaged portion of an existing concrete slab. For purposes of this disclosure, a preserved non-damaged portion of an existing concrete slab will simply be referred to as an existing concrete slab or a first concrete slab. Furthermore, the newly poured concrete slab will simply be referred to as a new concrete slab or a second concrete slab.

Thus, in both of these situations, a joint will be created between the existing concrete slab and the new concrete slab. Since a joint is created, various known issues involving joints between adjacent concrete slabs (i.e., the interface where one concrete slab meets another concrete slab) need to be considered and addressed.

5 One known issue with such joints involves the relative vertical movements of the adjacent existing and new concrete slabs relative to each other. The adjacent concrete slabs are preferably configured to move individually, and are also preferably configured with load transferring devices to transfer vertical loads from one concrete slab to the adjacent concrete slab. Transferring vertical loads between adjacent concrete slabs has
10 been accomplished using various different load transferring devices and methods. Various load transferring devices for adjacent concrete slabs are described in U.S. Patent No. 6,354,760.

U.S. Patent No. 8,356,955 describes load transferring devices for use between an existing concrete slab and a new concrete slab. U.S. Patent No. 8,356,955 and
15 Figure 1 of the present application generally illustrate a known cutting tool 10 cutting a cutaway 70 into a side edge 92 of an existing concrete slab 90. The shape of the cutaway 70 is semi-cylindrical due to the circular saw blade used to cut the cutaway 70.

U.S. Patent No. 8,356,955 and Figure 2 of the present application generally illustrate a known somewhat football shaped dowel 20 that has been used or proposed
20 to be used in such known existing concrete slabs. Specifically, one known method generally includes inserting a first portion of the known dowel 20 into the cutaway 70 after the cutaway 70 is formed in the existing concrete slab 90. This known method further includes attaching a known dowel receiving sheath 300 (such as one disclosed in U.S. Patent No. 6,354,760) over the other portion of the known dowel 20 (i.e., the
25 portion that does not protrude into the cutaway 70). The known method further includes pouring the concrete of the new concrete slab around the dowel receiving sheath 300 that is positioned on the dowel 20 and partially extends into the cutaway 70 of the existing concrete slab 90. When the new concrete cures, the dowel 20 is positioned to transfer loads between the existing concrete slab 90 and the adjacent new concrete
30 slab.

However, one problem that exists with such known dowels 20 and such known dowel receiving sheaths 300 is that the portion of the known dowel 20 that is inserted into the known dowel receiving sheath 300 does not conform to the shape of the known dowel receiving sheath 300. This problem increases relative movement between the new and existing concrete slabs in a direction parallel and perpendicular to the longitudinal axis of the joint, and also reduces loadings per square inch in the new and existing concrete slabs close to the joint when transferring vertical or substantially vertical loads from the existing concrete slab to the adjacent, new concrete slab.

Accordingly, there is a need for improved load transfer devices and methods of using such improved load transfer devices that solve these problems.

SUMMARY

Various embodiments of the present disclosure provide a load transfer apparatus including a load transfer plate and method of employing the load transfer plate that solves the above problems.

Various embodiments of the present disclosure provide a load transfer apparatus including a non-symmetrical load transfer plate that is configured to transfer vertical or substantially vertical loads from one concrete slab to an adjacent concrete slab in an enhanced manner in part by optimizing interaction with the load transfer pocket. More specifically, various embodiments of the load transfer plate of the present disclosure include a generally non-symmetrically shaped body having: (a) a tapered generally semi-cylindrical first half or portion configured to extend into and be secured in the existing concrete slab; and (b) a tapered trapezoidal second half or portion configured to be positioned in the load transfer plate pocket at installation and move with respect to the load transfer plate pocket that is configured to be secured in the new concrete slab.

Various other embodiments of the load transfer plate of the present disclosure include a generally non-symmetrically shaped body having: (a) a tapered generally semi-cylindrical first half or portion configured to protrude into and be secured in the existing concrete slab; and (b) a tapered generally triangular second half or portion configured to be positioned in the load transfer plate pocket at installation and move

with respect to the load transfer plate pocket that is configured to be secured in the new concrete slab.

In various example embodiments, the method of installing the load transfer plate of the present disclosure includes: (1) making a cutaway in a side edge of an existing concrete slab by using a cutting tool; (2) inserting the first portion of the load transfer plate in the cutaway of the side edge of the existing concrete slab; (3) inserting the second portion of the load transfer plate into a load transfer plate receiving opening of a load transfer plate pocket and further into the load transfer plate receiving chamber of the load transfer plate pocket such that the load transfer plate pocket and the load transfer plate protrude into an area to be occupied by a new concrete slab; (4) pouring the concrete material that forms the new cast-in-place concrete slab into the area to be occupied by the new concrete slab; and (5) allowing the new concrete slab to cure or harden.

Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description and the Figures.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a diagrammatic side perspective view of a known cutting tool used to cut a cutaway into the side edge of an existing concrete slab.

Figure 2 is a top perspective view of a known load transfer plate.

Figure 3 is a top perspective view of the load transfer plate of one example embodiment of the present disclosure.

Figure 4A is a top perspective view of a load transfer plate pocket used when installing the load transfer plate of Figure 3.

Figure 4B is a fragmentary top perspective view of the load transfer plate pocket of Figure 4A, showing interior portions of the load transfer plate pocket.

Figure 5 is a top perspective view of an existing cast-in-place concrete slab and the cutaway made by the cutting tool of Figure 1 in the side edge of the existing cast-in-place concrete slab.

Figures 6 and 7 are a top cross-sectional view and a side cross-sectional view of a first portion of the load transfer plate of Figure 3 positioned in the cutaway made in the

side of edge of the existing concrete slab during installation and a second portion of the load transfer plate of Figure 3 extending outwards in an area to be occupied by the new concrete slab.

Figures 8 and 9 are a top cross-sectional view and a side cross-sectional view of the first portion of the load transfer plate of Figure 3 positioned in the cutaway made in the side of edge of the existing concrete slab during installation and the second portion of the load transfer plate of Figure 3 encapsulated by the load transfer plate pocket before the concrete material is poured to make the new concrete slab.

Figures 10 and 11 are a top cross-sectional view and a side cross-sectional view of the first portion of the load transfer plate of Figure 3 positioned in the cutaway made in the side of edge of the existing concrete slab during installation and the second portion of the load transfer plate of Figure 3 encapsulated by the load transfer plate positioned in the new concrete slab after the concrete material is poured to make the new concrete slab.

Figure 12A is a top perspective view of an alternative example embodiment of the load transfer plate of the present disclosure.

Figure 12B is an enlarged cross-sectional view of the load transfer plate of Figure 12A taken substantially along line 12B-12B of Figure 12A.

Figure 12C is an enlarged cross-sectional view of the load transfer plate of Figure 12A taken substantially along line 12C-12C of Figure 12A.

Figure 13 is a top perspective view of a further alternative example embodiment of the load transfer plate of the present disclosure.

Figure 14 is a top perspective view of a further alternative example embodiment of the load transfer plate of the present disclosure.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

Various embodiments of the present disclosure provide an improved load transfer plate that is configured to work with a load transfer plate pocket and that solves the above problems. The load transfer plate is configured to transfer loads between an existing slab (such as a first or existing concrete slab) and a new adjacent slab (such as a second or new concrete slab).

Referring now to Figures 3, 4A, 4B, 5, 6, 7, 8, 9, 10, and 11, one example embodiment of the load transfer plate of the present disclosure is generally indicated by numeral 100. Figures 1, 5, 6, 7, 8, 9, 10, and 11 also generally partially illustrate one method of employing or installing the load transfer plate 100 of the present disclosure with a load transfer plate pocket 300 in an existing cast-in-place slab (such as existing concrete slab 90) and a new cast-in-place slab (such as new concrete slab 96). It should be appreciated that multiple spaced apart sets of load transfer plates 100 of the present disclosure and multiple load transfer plate pockets 300 can be employed in such adjacent existing and new concrete slabs to co-act to transfer vertical or substantially vertical loads from one concrete slab to the adjacent concrete slab in an enhanced manner in part by optimizing the positions of the load transfer plates 100 relative to the load transfer plate pockets 300 for load transfer between the adjacent existing and new concrete slabs.

In this illustrated example embodiment, the load transfer plate 100 includes a generally non-symmetrically shaped body 110 having: (a) a tapered, generally semi-cylindrical first half or portion 112 configured to protrude into a cutaway 70 made in a side edge 92 of the first concrete slab 90; and (b) a tapered, generally trapezoidal second half or portion 114 configured to be partially positioned in the load transfer plate pocket 300 at installation and also protrude into and be secured in the new concrete slab 96.

The body 110 of the load transfer plate 100 also generally includes: (a) a substantially planar upper surface 120; (b) a substantially planar lower surface 130; (c) a first outer edge 140; (d) a second outer edge 150; (e) a third outer edge 160; and (f) a fourth outer edge 170.

The first outer edge 140 extends perpendicular or substantially perpendicular to the upper surface 120 and to the lower surface 130 and is generally semi-cylindrical. The second outer edge 150 extends perpendicular or substantially perpendicular to the upper surface 120 and to the lower surface 130 and is generally straight. The third outer edge extends perpendicular or substantially perpendicular to the upper surface 120 and to the lower surface 130 and is generally straight. The fourth outer edge 170 extends perpendicular or substantially perpendicular to the upper surface 120 and to the lower

surface 130 and is generally straight. It should be appreciated that the shape of these outer edges may vary in accordance with the present disclosure, such as discussed below.

5 In this illustrated example embodiment, the tapered first portion 112 has a largest width (measured parallel to the longitudinal axis of the joint) at the area of the first portion 112 adjacent to the tapered second portion 114, and a narrower width adjacent to the first outer edge 140. In this illustrated example embodiment, the first portion 112 is uniformly tapered from the area of the first portion 112 adjacent to second portion 114 to the point 113; however, such taper does not have to be uniform in accordance with
10 the present disclosure.

In this illustrated example embodiment, the tapered second portion 114 has a largest width (measured parallel to the longitudinal axis of the joint) at the area of the second portion 114 adjacent to the tapered first portion 112, and a narrower width adjacent to the third outer edge 160. In this illustrated example embodiment, the second
15 portion 114 is uniformly tapered from the area of the second portion 114 adjacent to first portion 112 to the third outer edge 160; however, such taper does not have to be uniform in accordance with the present disclosure.

Accordingly, in this illustrated example embodiment, the load transfer plate 100 has its greatest width at the area where the first portion 112 and the second portion 114 meet or connect (i.e., along the center line or plane 116). Additionally, the first portion
20 112 and the second portion 114 are not symmetrical.

In this illustrated example embodiment, the load transfer plate 100 is also relatively wide compared to its thickness or height and has a length to width ratio of approximately 1:1; however, it should be appreciated that the width compared to the
25 thickness or height may vary, and that the length to width ratio may vary in accordance with the present disclosure.

One example load transfer plate pocket 300 that can be used in installing the load transfer plate 100 in the new concrete slab 96 is shown in Figures 4A and 4B. This example load transfer plate pocket 300 includes a concrete side edge engager 310 and
30 a generally triangular shaped body 320 integrally formed and extending from the back or back face of the concrete side edge engager 310. The body 320 of this illustrated

example load transfer plate pocket 300 includes: (a) a triangular upper wall 330; (b) a triangular lower wall 340; (c) a first side wall 350; and (d) a second side wall 360.

More specifically, the concrete side edge engager 310 in this illustrated example embodiment includes a generally flat rectangular body 311 that defines a load transfer plate receiving opening or slot 312. The load transfer plate receiving opening or slot 312 is configured such that the load transfer plate 100 can move freely through the load transfer plate receiving opening or slot 312 when installing the load transfer plate pocket 300 on the load transfer plate 100.

The triangular upper wall 330 is integrally formed with and extends from the back or back face of the body 311 of the concrete side edge engager 310 above the load transfer plate receiving opening or slot 312. The triangular lower wall 340 is integrally formed with and extends from the back or back face of the body 311 of the concrete side edge engager 310 below the load transfer plate receiving opening or slot 312. The triangular lower wall 340 is thus spaced apart from the triangular upper wall 330 such that the load transfer plate 100 can move freely between the lower wall 340 and the upper wall 330 when vertical loads are placed on the load transfer plate 100.

The first side wall 350 is integrally formed with and extends from the back or back face of the body 311 of the concrete side edge engager 310 adjacent to one side of the load transfer plate receiving opening or slot 312. The first side wall 350 is also integrally connected to the triangular upper wall 330. The first side wall 350 is also integrally connected to the triangular lower wall 330.

The second side wall 360 is integrally formed with and extends from the back or back face of the body 311 of the concrete side edge engager 310 adjacent to one side of the load transfer plate receiving opening or slot 312. The second side wall 360 is also integrally connected to the triangular upper wall 330. The second side wall 360 is also integrally connected to the triangular lower wall 330. The second side wall 360 is integrally formed with and extends the first side wall 350.

The concrete side edge engager 310, the triangular upper wall 330, the triangular lower wall 340, the first side wall 350, and the second side wall 360 define a load transfer plate receiving chamber or area 308 that in this illustrated example embodiment

is configured to receive the entire second half or portion 114 of the load transfer plate 100 as generally shown in Figures 4A and 4B.

As indicated or mentioned above, the present disclosure further provides a method of installing the load transfer plate 100 of the present disclosure with using the known load transfer plate pocket 300 for transferring loads between the existing cast-in-place concrete slab 90 and the new cast-in-place concrete slab 96. In various embodiments, the method generally includes the steps of: (1) making a cutaway 70 in the side edge 92 of the existing concrete slab 90 by using the cutting tool 10; (2) inserting the first portion 112 of the load transfer plate 100 into the cutaway 70 of the side edge 92 of the existing concrete slab 90; (3) inserting the second portion 114 of the load transfer plate 100 through the load transfer plate receiving opening 312 and into the load transfer plate receiving chamber 308 of the load transfer plate pocket 300 such that the load transfer plate pocket 300 and the load transfer plate 100 protrude into the area to be occupied by the new concrete slab 96; (4) pouring the concrete material that forms the new cast-in-place concrete slab 96 into the area to be occupied by the new concrete slab 96; and (5) allowing the new concrete slab 96 to cure or harden.

More specifically, the area that is generally occupied by the new concrete slab 96 is vacant. In other words, (a) the new concrete slab 96 has not yet been poured in the area next to the existing concrete slab 90; or (b) an old concrete slab has been removed and is to be replaced later by a newly poured concrete slab, such as the new concrete slab 96. The cutting tool 10 is used to cut the cutaway 70 into the side edge 92 of the existing concrete slab 90 by positioning the cutting tool 10 on an upper surface 94 of the first concrete slab 90, as illustrated in Figures 1 and 5. The shape of the cutaway 70 is semi-cylindrical due to the circular saw blade used to cut the cutaway 70. The upper and lower surfaces of the cutaway 70 are generally parallel to the upper surface 94 of the existing concrete slab 90.

After making the cutaway 70 into the side edge 92 of the existing concrete slab 90, the method of certain embodiments of the present disclosure includes using epoxy to secure the load transfer plate 100 in the cutaway 70. In certain embodiments, epoxy is applied to one or more outer edges of the load transfer plate 100 that engage the one or more inner surfaces of the cutaway 70. In other embodiments, epoxy is applied to the

one or more inner surfaces of the cutaway 70 prior to inserting the load transfer plate 100 into the cutaway 70. The method further includes positioning the first half or portion 112 of the load transfer plate 100 in the cutaway 70 of the first slab, as illustrated in Figures 6 and 7. The epoxy generally causes the first half or portion 112 of the load transfer plate 100 to not move relative to the cutaway 70 of the existing slab 90 when the central line between the two concrete slabs 90 and 96 moves and/or when vertical loads are placed on the load transfer plate 100. The method further includes installing the load transfer plate pocket 300 onto the load transfer plate 100 by inserting the second half or portion 114 of the load transfer plate 100 into the load transfer plate receiving opening 312 and further into the load transfer plate receiving chamber 308 of the load transfer plate pocket 300 such that the concrete side engager 310 of the load transfer plate pocket 300 engages the side edge 92 of the existing concrete slab 90, as illustrated in Figures 8 and 9. A gap may exist between the upper surface 120 of the load transfer plate 100 and the upper wall 330 of the load transfer plate pocket 300 or between the lower surface 130 of the load transfer plate 100 and the lower wall 340 of the load transfer plate pocket 300 so that the load transfer plate 100 can move freely between the lower wall 340 and the upper wall 330 when vertical loads are placed on the load transfer plate 100.

After positioning the load transfer plate pocket 300 onto the load transfer plate 100, the method further includes pouring the concrete material that forms the new cast-in-place concrete slab 96 into the area to be occupied by the new concrete slab 96, as illustrated in Figures 10 and 11. By doing so, the second half or portion 114 of the load transfer plate 100 protruding in the load transfer plate pocket 300 extends into the new concrete slab 96 and is maintained in the new concrete slab 96 after the new concrete slab 96 is poured and hardened or cured.

It should be appreciated that in an alternative method of the present disclosure, if slab 96 is the existing concrete slab and slab 90 is the new concrete slab, then the cutaway 70 is made in the side edge of slab 96, which is configured to partially receive a portion of the load transfer plate 100. The load transfer plate pocket 300 partially receives another portion of the load transfer plate 100 that is not extending into the cutaway 70. Concrete material that forms the existing cast-in-place concrete slab 90 is

poured into the area to be occupied by the existing concrete slab 90 such that the load transfer plate pocket 300 partially receiving a portion of the load transfer plate 100 extends into the first concrete slab 90 and is maintained in the first concrete slab 90 after the first concrete slab 90 is poured and hardened or cured.

5 Referring now to Figures 12A, 12B, and 12C, another example embodiment of the load transfer plate of the present disclosure is generally indicated by numeral 1100. This example embodiment is different in that the load transfer plate 1100 includes three part, multiple angled, or chamfered outer edges instead of straight outer edges.

10 In this illustrated example embodiment, the load transfer plate 1100 includes a generally non-symmetrically shaped body 1110 having: (a) a tapered, generally semi-cylindrical first half or portion 1112 configured to protrude into the cutaway 70 made in the straight edge of the existing concrete slab 90; and (b) a tapered, generally trapezoidal second half or portion 1114 configured to be partially positioned in the load transfer plate pocket 300 at installation and also protrude into and be secured in the
15 new concrete slab 96.

The body 1110 of the load transfer plate 1100 also generally includes: (a) a substantially planar upper surface 1120; (b) a substantially planar lower surface 1130; (c) a first outer edge 1140; (d) a second outer edge 1150; (e) a third outer edge 1160; and (f) a fourth outer edge 1170.

20 The first outer edge 1140 is generally semi-cylindrical and includes: (a) a generally semi-cylindrical side edge 1142 that extends perpendicular to the upper surface 1120 and to the lower surface 1130; (b) a generally semi-cylindrical top angled edge 1144 that extends downwardly at an obtuse angle from the upper surface 1120 to the side edge 1142, and that extends upwardly at an obtuse angle from the side edge
25 1142 to the upper surface 1120; and (c) a generally semi-cylindrical bottom angled edge 1146 that extends upwardly at an obtuse angle from the lower surface 1130 to the side edge 1142, and that extends downwardly at an obtuse angle from the side edge 1142 to the lower surface 1130.

The second outer edge 1150 includes: (a) a side edge 1152 that extends
30 perpendicular to the upper surface 1120 and to the lower surface 1130; (b) a top angled edge 1154 that extends downwardly at an obtuse angle from the upper surface 1120 to

the side edge 1152, and that extends upwardly at an obtuse angle from the side edge 1152 to the upper surface 1120; and (c) a bottom angled edge 1156 that extends upwardly at an obtuse angle from the lower surface 1130 to the side edge 1152, and that extends downwardly at an obtuse angle from the side edge 1152 to the lower surface 1130.

The third outer edge 1160 includes: (a) a side edge 1162 that extends perpendicular to the upper surface 1120 and to the lower surface 1130; (b) a top angled edge 1164 that extends downwardly at an obtuse angle from the upper surface 1120 to the side edge 1162, and that extends upwardly at an obtuse angle from the side edge 1162 to the upper surface 1120; and (c) a bottom angled edge 1166 that extends upwardly at an obtuse angle from the lower surface 1130 to the side edge 1162, and that extends downwardly at an obtuse angle from the side edge 1162 to the lower surface 1130.

The fourth outer edge 1170 includes: (a) a side edge 1172 that extends perpendicular to the upper surface 1120 and to the lower surface 1130; (b) a top angled edge 1174 that extends downwardly at an obtuse angle from the upper surface 1120 to the side edge 1172, and that extends upwardly at an obtuse angle from the side edge 1172 to the upper surface 1120; and (c) a bottom angled edge 1176 that extends upwardly at an obtuse angle from the lower surface 1130 to the side edge 1172, and that extends downwardly at an obtuse angle from the side edge 1172 to the lower surface 1130.

In this illustrated example embodiment, the three part, multiple angled, or chamfered outer edges 1140, 1150, 1160, and 1170 reduce the concentrated stresses that the outer edges of the load transfer plate 1100 place on the portions of the concrete slab when which vertical loads are placed on the load transfer plate 1100. More specifically, these three part multiple angled or chamfered outer edges 1140, 1150, 1160, and 1170 spread the forces from a single line along the concrete slab to a wider area to reduce the concentrated stresses that the outer edges of the load transfer plate 1100 place on the portions of the concrete slab when vertical loads are placed on the load transfer plate 1100. These three part multiple angled or chamfered outer edges 1140, 1150, 1160, and 1170 additionally increase the amount of vertical load that can

be placed on the load transfer plate 1100 before the load transfer plate 1100 causes a crack in the concrete slab.

In this illustrated example embodiment, the tapered first portion 1112 has a largest width (measured parallel to the longitudinal axis of the joint) at the area of the first portion 1112 adjacent to tapered second portion 1114, and a narrower width adjacent to the first outer edge 1140. In this illustrated example embodiment, the first portion 1112 is uniformly tapered from the area of the first portion 1112 adjacent to the second portion 1114 to the point 1113; however, such taper does not have to be uniform in accordance with the present disclosure.

In this illustrated example embodiment, the tapered second portion 1114 has a largest width (measured parallel to the longitudinal axis of the joint) at the area of the second portion 1114 adjacent to the tapered first portion 1112, and a narrower width adjacent to the third outer edge. In this illustrated example embodiment, the second portion 1114 is uniformly tapered from the area of the second portion 1114 adjacent to first portion 1112 to the third outer edge 1160; however, such taper does not have to be uniform in accordance with the present disclosure.

Accordingly, in this illustrated example embodiment, the load transfer plate 1100 has its greatest width at the area where the tapered first portion 1112 and the tapered second portion 1114 meet or connect (i.e., along the center line or plane 1116). In this illustrated example embodiment, the load transfer plate 1100 is also relatively wide compared to its thickness or height and has a length to width ratio of approximately 1:1; however, it should be appreciated that the width compared to the thickness or height may vary, and that the length to width ratio may vary in accordance with the present disclosure.

Referring now to Figure 13, another example embodiment of the load transfer plate of the present disclosure is generally indicated by numeral 2100. This example embodiment is different in that the load transfer plate 2100 includes somewhat semi-cylindrical, rounded, or curved sides instead of three part, multiple angled, or chamfered outer edges or straight outer edges.

In this illustrated example embodiment, the load transfer plate 2100 includes a generally non-symmetrically shaped body 2110 having: (a) a tapered, generally semi-

cylindrical first half or portion 2112 configured to protrude into the cutaway 70 made in the straight edge of the existing concrete slab 90; and (b) a tapered, generally trapezoidal second half or portion 2114 configured to be partially positioned in the load transfer plate pocket 300 at installation and also protrude into and be secured in the new concrete slab 96.

The body 2110 of the load transfer plate 2100 also generally includes: (a) a substantially planar upper surface 2120; (b) a substantially planar lower surface 2130; (c) a first generally semi-cylindrical outer edge 2140; (d) a second outer edge 2150; (e) a third outer edge 2160; and (f) a fourth outer edge 2170.

The first outer edge includes a somewhat semi-cylindrical, rounded, or curved side edge. The second outer edge 2150 includes a somewhat semi-cylindrical, rounded, or curved side. The third outer edge 2160 includes a somewhat semi-cylindrical, rounded, or curved side edge. The fourth outer edge 2170 includes a somewhat semi-cylindrical, rounded, or curved side edge.

In this illustrated example embodiment, the tapered first portion 2112 has a largest width (measured parallel to the longitudinal axis of the joint) at the area of the first portion 2112 adjacent to tapered second portion 2114, and a narrower width adjacent to the first outer edge 2140. In this illustrated example embodiment, the first portion 2112 is uniformly tapered from the area of the first portion 2112 adjacent to the second portion 2114 to the point 2113; however, such taper does not have to be uniform in accordance with the present disclosure.

In this illustrated example embodiment, the tapered second portion 2114 has a largest width (measured parallel to the longitudinal axis of the joint) at the area of the second portion 2114 adjacent to the tapered first portion 2112, and a narrower width adjacent to the third outer edge 2160. In this illustrated example embodiment, the second portion 2114 is uniformly tapered from the area of the second portion 2114 adjacent to the first portion 2112 to the third outer edge 2160; however, such taper does not have to be uniform in accordance with the present disclosure.

Accordingly, in this illustrated example embodiment, the load transfer plate 2100 has its greatest width at the area where the tapered first portion 2112 and the tapered second portion 2114 meet or connect (i.e., along the center line or plane 2116).

In this illustrated example embodiment, the load transfer plate 2100 is also relatively wide compared to its thickness or height and has a length to width ratio of approximately 1:1; however, it should be appreciated that the width compared to the thickness or height may vary, and that the length to width ratio may vary in accordance with the present disclosure.

Referring now to Figure 14, another example embodiment of the load transfer plate of the present disclosure is generally indicated by numeral 3100. This example embodiment is different in that the load transfer plate 3100 includes a generally triangular second half or portion instead of a generally trapezoidal second half or portion.

In this illustrated example embodiment, the load transfer plate 3100 includes a generally non-symmetrically shaped body 3110 having: (a) a tapered, generally semi-cylindrical first half or portion 3112 configured to protrude into the cutaway 70 made in the straight edge of the existing concrete slab 90; and (b) a tapered, generally triangular second half or portion 3114 configured to be partially positioned in the load transfer plate pocket 300 at installation and also protrude into and be secured in the new concrete slab 96.

The body 3110 of the load transfer plate 3100 also generally includes: (a) a substantially planar upper surface 3120; (b) a substantially planar lower surface 3130; (c) a first outer edge 3140; (d) a second outer edge 3150; and (e) a third outer edge 3160. The first outer edge 3140 extends perpendicular or substantially perpendicular to the upper surface 3120 and to the lower surface 3130 and is generally semi-cylindrical. The second outer edge 3150 extends perpendicular or substantially perpendicular to the upper surface 3120 and to the lower surface 3130 and is generally straight. The third outer edge 3160 extends perpendicular or substantially perpendicular to the upper surface 3120 and to the lower surface 3130 and is generally straight.

It should be appreciated that the outer edges 3140, 3150, and 3160 can include one or more angled side edges. It should further be appreciated that the outer edges 3140, 3150, and 3160 can include a somewhat semi-cylindrical, rounded, or curved side edge.

In this illustrated example embodiment, the tapered first portion 3112 has a largest width (measured parallel to the longitudinal axis of the joint) at the area of the first portion 3112 adjacent to the tapered second portion 3114, and a narrower width adjacent to the first outer edge 3140.. In this illustrated example embodiment, the first
5 portion 3112 is uniformly tapered from the area of the first portion 3112 adjacent the second portion 3114 to the point 3113; however, such taper does not have to be uniform in accordance with the present disclosure.

In this illustrated example embodiment, the tapered second portion 3114 has a largest width (measured parallel to the longitudinal axis of the joint) at the area of the
10 second portion 3114 adjacent to tapered first portion 3112, and a narrower width at the point 3118. In this illustrated example embodiment, the second portion 3114 is uniformly tapered from the area of the second portion 3114 adjacent to first portion 3112 to the point 3118; however, such taper does not have to be uniform in accordance with the present disclosure.

15 Accordingly, in this illustrated example embodiment, the load transfer plate 1100 has its greatest width at the area where the tapered first portion 3112 and the tapered second portion 3114 meet or connect (i.e., along the center line or plane 3116).

In this illustrated example embodiment, the load transfer plate 3100 is also relatively wide compared to its thickness or height and has a length to width ratio of
20 approximately 1:1; however, it should be appreciated that the width compared to the thickness or height may vary, and that the length to width ratio may vary in accordance with the present disclosure.

It should be appreciated that in an alternative method of the present disclosure, it is not necessary to use epoxy when installing the load transfer plate pocket of the
25 present disclosure. This enables various embodiments of the load transfer plate of the present disclosure to move with respect to the cutaway 70 when vertical loads are placed on the load transfer plate of the present disclosure.

It should further be appreciated that various load transfer plates of the present disclosure can be installed in the first concrete slab and the second concrete slab using
30 a load transfer place pocket having a generally trapezoidal shaped body.

It should further be appreciated that suitable tape can be applied to where the load transfer plate pocket 300 engages the side edge 92 of the existing concrete slab 90 to prevent wet cement from pouring into the load transfer plate receiving opening 312.

5 It should further be appreciated that various embodiments of the load transfer plate of the present disclosure can include one or more interior edges that define one or more slab attachment openings. These slab attachment openings enable concrete of the second slab to extend through the load transfer plate when the load transfer plate is positioned in the load transfer plate pocket and concrete that forms the second slab is
10 poured. This causes the load transfer plate to be secured or locked to the second concrete slab after this concrete slab cures or hardens. Thus, the load transfer plate moves with the shrinkage of the second concrete slab and also moves with any other subsequent movement of the second concrete slab.

It should further be appreciated that various embodiments of the load transfer
15 plate of the present disclosure can include a generally non-symmetrically shaped body having: (a) a tapered first half or portion configured to protrude into the cutaway made in the straight edge of the existing concrete slab 90; and (b) a tapered second half or portion configured to be partially positioned in the load transfer plate pocket 300 at installation and also protrude into and be secured in the new concrete slab 96, wherein
20 the first half or portion is configured to have a generally semi-cylindrical shape and the second half or portion is configured to have an alternative suitable shape that does not mirror the shape of the first half or portion.

It should further be appreciated that another suitable cutting tool can be used when installing the various example embodiments of the load transfer plate of the
25 present disclosure in the existing concrete slab and the new concrete slab.

It should be appreciated from the above that in various embodiments the present disclosure provides a load transfer plate for transferring loads across a joint between a first or existing cast-in-place concrete slab and a second or new cast-in-place concrete slab, the load transfer plate comprising: a non-symmetrically shaped body having: (i) a
30 first, generally semi-cylindrical portion configured to protrude into and be secured in the first cast-in-place concrete slab; (ii) a second, generally trapezoidal portion configured to

protrude into a load transfer plate pocket secured in the second cast-in-place concrete; (iii) a substantially planar upper surface; and (iv) a substantially planar lower surface.

It should also be appreciated from the above that in various embodiments the present disclosure provides a load transfer plate for transferring loads across a joint
5 between a first or existing cast-in-place concrete slab and a second or new cast-in-place concrete slab, the load transfer plate comprising: a non-symmetrically shaped body having: (i) a first, generally semi-cylindrical portion configured to protrude into and be secured in the first cast-in-place concrete slab; (ii) a second, generally triangular portion configured to protrude into a load transfer plate pocket secured in the second
10 cast-in-place concrete; (iii) a substantially planar upper surface; and (iv) a substantially planar lower surface.

It should also be appreciated from the above that in various embodiments the present disclosure provides a load transfer plate for transferring loads across a joint between a first or existing cast-in-place concrete slab and a second or new cast-in-place concrete slab, the load transfer plate comprising: a non-symmetrically shaped
15 body having: (a) a semi-cylindrical first portion configured to protrude into and be secured in the first cast-in-place concrete slab; (b) a non-semi cylindrical second portion configured to protrude into a load transfer plate pocket secured in the second cast-in-place concrete; (c) a substantially planar upper surface; and (d) a substantially planar
20 lower surface.

In certain such embodiments of the load transfer plate, the second portion has a trapezoidal shape.

In certain such embodiments of the load transfer plate, the second portion has a triangular shape.

25 In certain such embodiments of the load transfer plate, the first portion has a semi-cylindrical shape and the second portion has a generally trapezoidal shape.

In certain such embodiments of the load transfer plate, the first portion has a semi-cylindrical shape and the second portion has a triangular shape.

It should also be appreciated from the above that in various embodiments the present disclosure provides a method for transferring loads across a joint between
30 concrete first cast-in-place concrete slab and a second cast-in-place concrete slab, said

method comprising: (a) cutting a cutaway in a side edge of the first cast-in-place concrete slab; (b) positioning a semi-cylindrical first portion of a load transfer plate into the cutaway of the side edge of the first cast-in-place concrete slab; (c) positioning a non-semi cylindrical second portion of the load transfer plate into a load transfer plate receiving opening and further into a load transfer plate receiving chamber of a load transfer plate pocket such that the load transfer plate pocket and the load transfer plate protrude into an area to be occupied by the second cast-in-place concrete slab; (d) pouring concrete material that forms the second cast-in-place concrete slab into the area to be occupied by the second cast-in-place concrete slab; and (e) allowing the second cast-in-place concrete slab to cure or harden.

It should be understood that various changes and modifications to the presently preferred example embodiments described herein will be apparent to those skilled in the art. Such change and modifications can be made without departing from the spirit and scope of the present subject matter and without diminishing its intended advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

CLAIMS

The invention is claimed as follows:

1. A load transfer plate for transferring loads across a joint between a first or
5 existing cast-in-place concrete slab and a second or new cast-in-place concrete slab,
the load transfer plate comprising:
a non-symmetrically shaped body having:
(i) a first, generally semi-cylindrical portion configured to protrude
into and be secured in the first cast-in-place concrete slab;
10 (ii) a second, generally trapezoidal portion configured to protrude
into a load transfer plate pocket secured in the second cast-in-place concrete;
(iii) a substantially planar upper surface; and
(iv) a substantially planar lower surface.
- 15 2. A load transfer plate for transferring loads across a joint between a first or
existing cast-in-place concrete slab and a second or new cast-in-place concrete slab,
the load transfer plate comprising:
a non-symmetrically shaped body having:
(i) a first, generally semi-cylindrical portion configured to protrude
20 into and be secured in the first cast-in-place concrete slab;
(ii) a second, generally triangular portion configured to protrude into
a load transfer plate pocket secured in the second cast-in-place concrete;
(iii) a substantially planar upper surface; and
(iv) a substantially planar lower surface.

3. A load transfer plate for transferring loads across a joint between a first or existing cast-in-place concrete slab and a second or new cast-in-place concrete slab, the load transfer plate comprising:

a non-symmetrically shaped body having:

(a) a semi-cylindrical first portion configured to protrude into and be secured in the first cast-in-place concrete slab;

(b) a non-semi cylindrical second portion configured to protrude into a load transfer plate pocket secured in the second cast-in-place concrete;

(c) a substantially planar upper surface; and

(d) a substantially planar lower surface.

4. The load transfer plate of Claim 3, wherein the second portion has a trapezoidal shape

5. The load transfer plate of Claim 3, wherein the second portion has a triangular shape.

6. The load transfer plate of Claim 3, wherein the first portion has a semi-cylindrical shape and the second portion has a generally trapezoidal shape.

7. The load transfer plate of Claim 3, wherein the first portion has a semi-cylindrical shape and the second portion has a triangular shape.

8. A method for transferring loads across a joint between concrete first cast-in-place concrete slab and a second cast-in-place concrete slab, said method comprising:

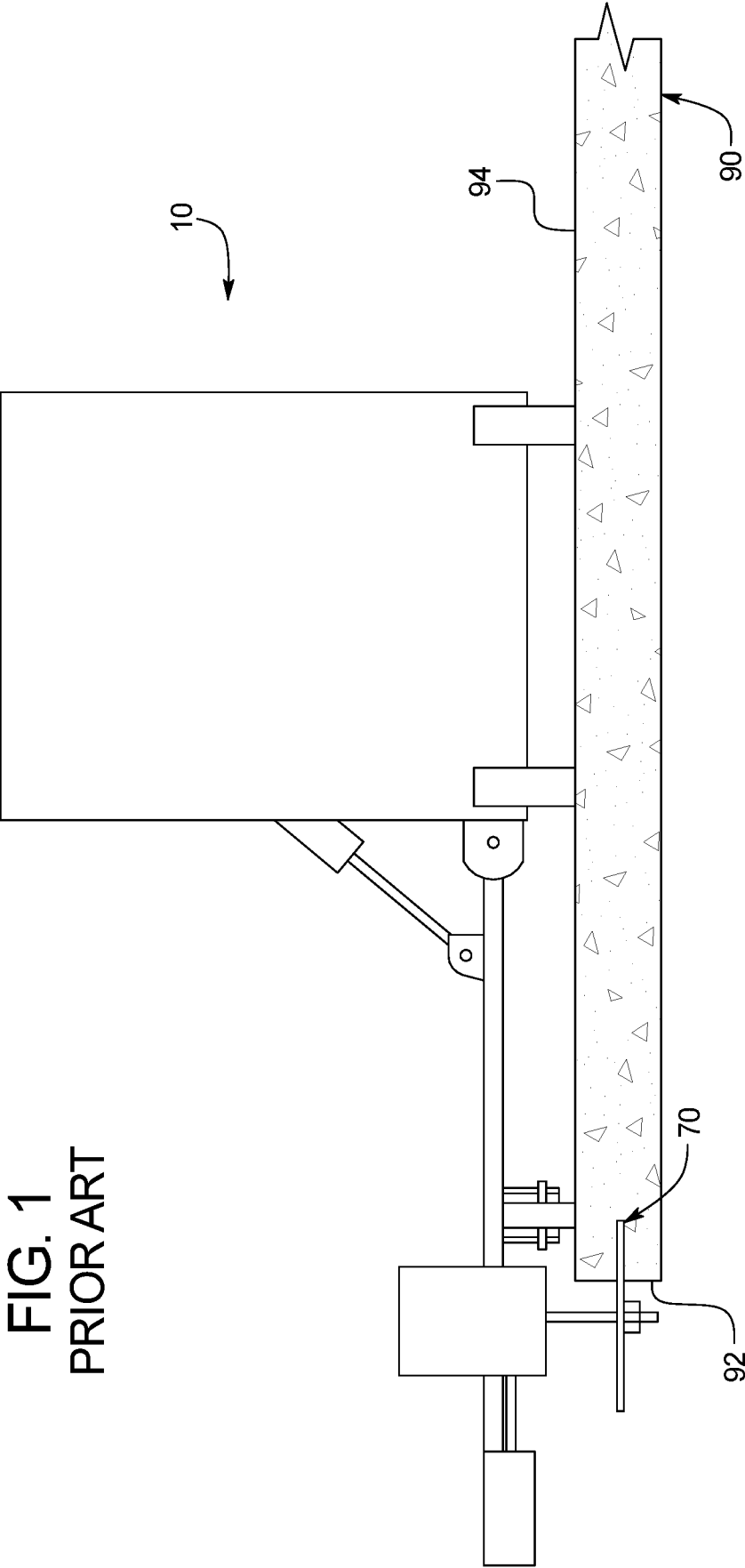
(a) cutting a cutaway in a side edge of the first cast-in-place concrete slab;

(b) positioning a semi-cylindrical first portion of a load transfer plate into the cutaway of the side edge of the first cast-in-place concrete slab;

(c) positioning a non-semi cylindrical second portion of the load transfer plate into a load transfer plate receiving opening and further into a load transfer plate receiving

chamber of a load transfer plate pocket such that the load transfer plate pocket and the load transfer plate protrude into an area to be occupied by the second cast-in-place concrete slab;

- (d) pouring concrete material that forms the second cast-in-place concrete slab
- 5 into the area to be occupied by the second cast-in-place concrete slab; and
- (e) allowing the second cast-in-place concrete slab to cure or harden.



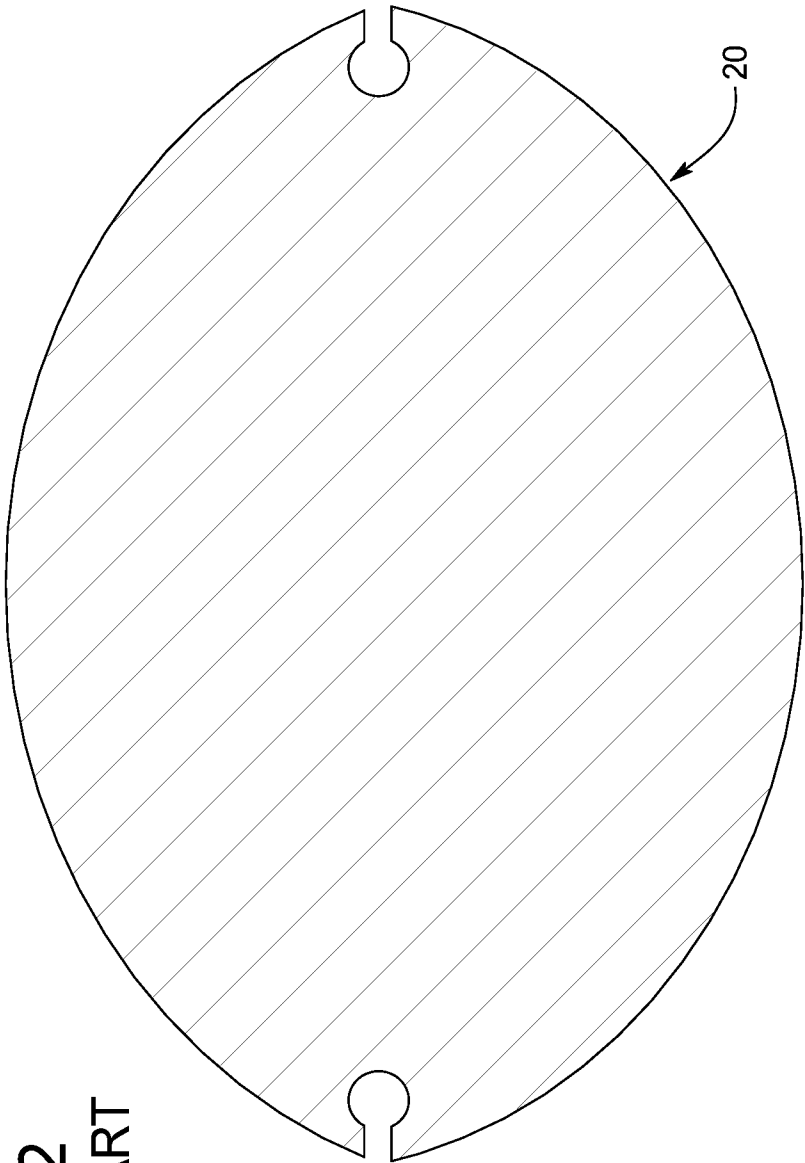


FIG. 2
PRIOR ART

FIG. 3

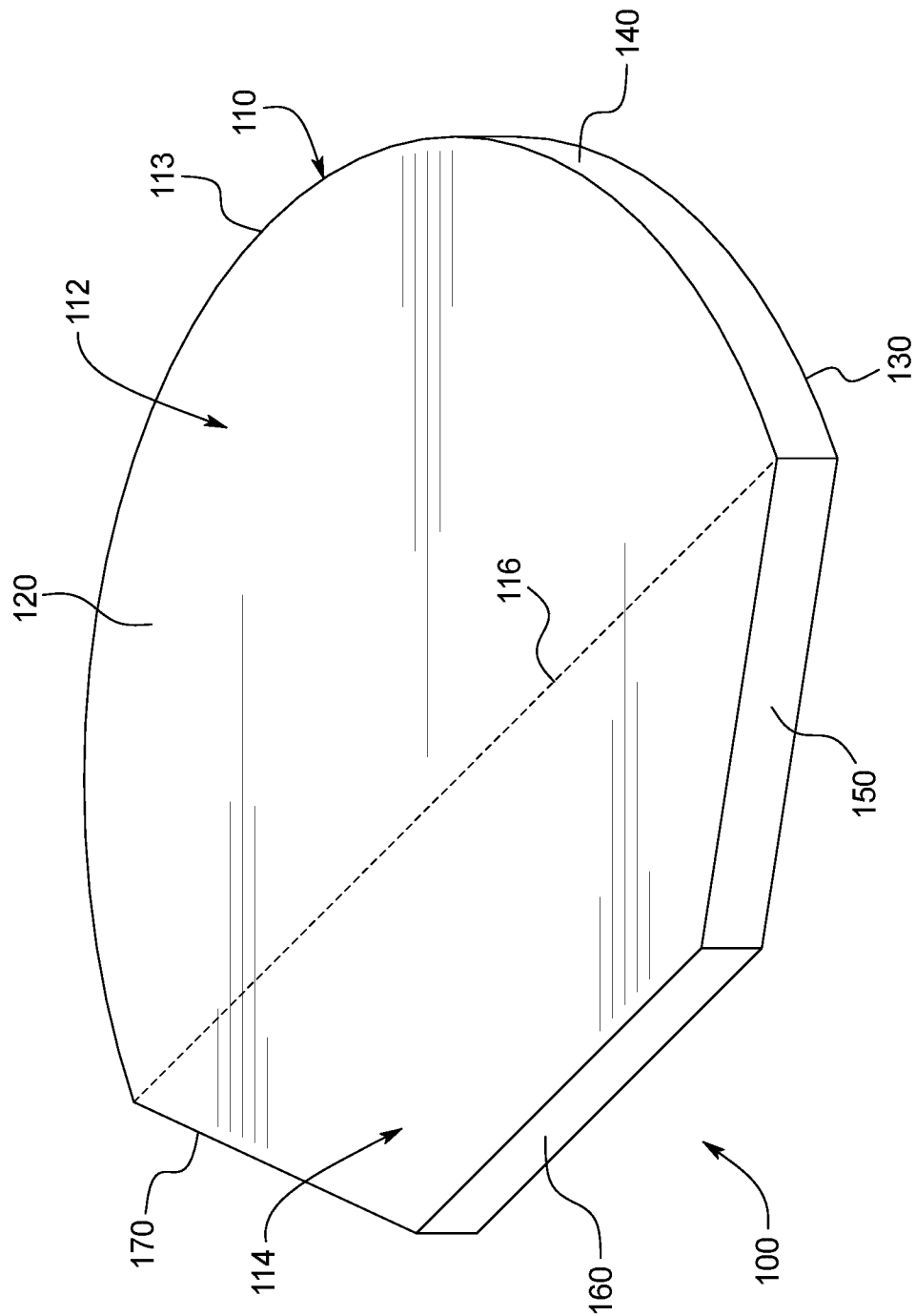


FIG. 4A

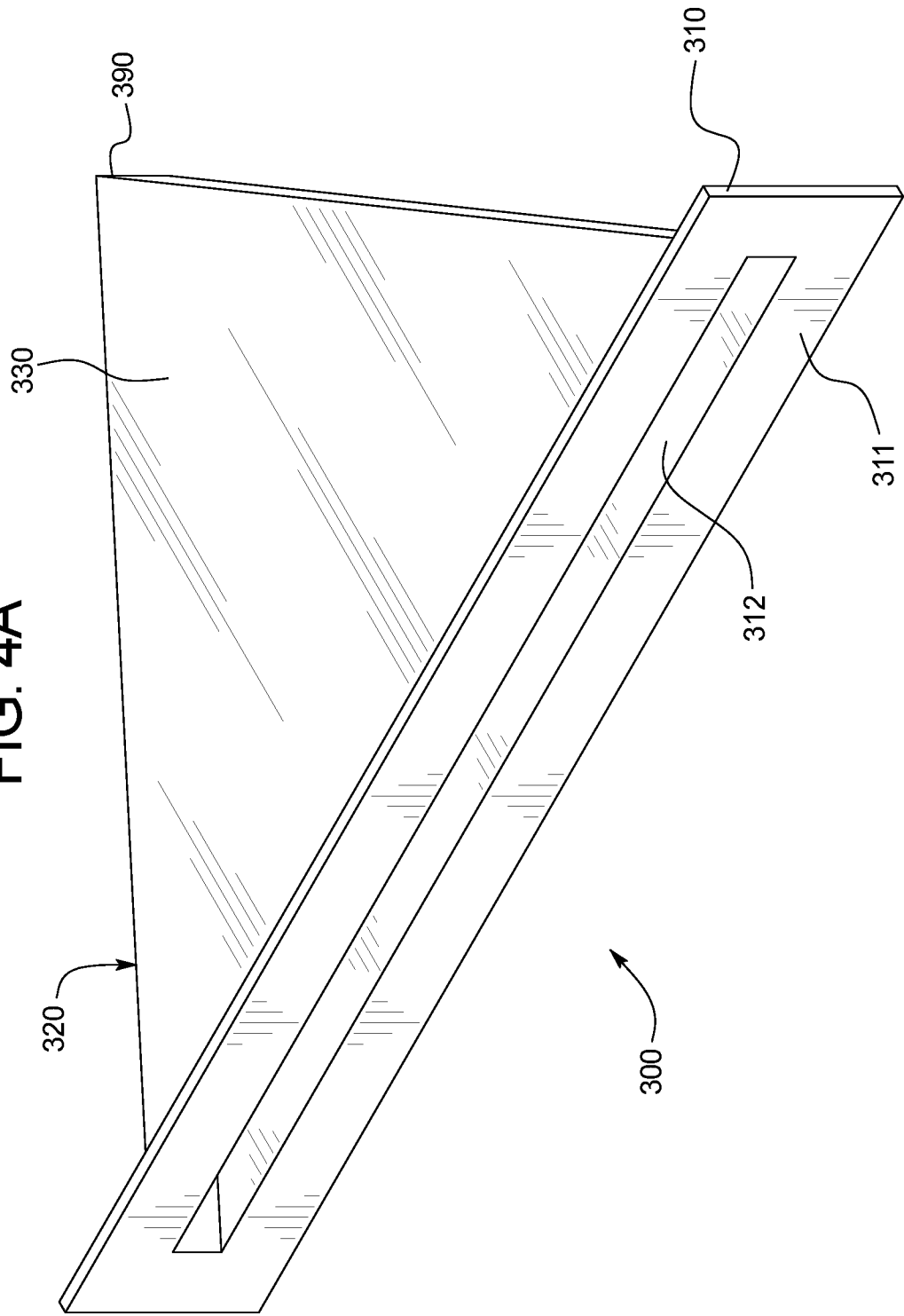
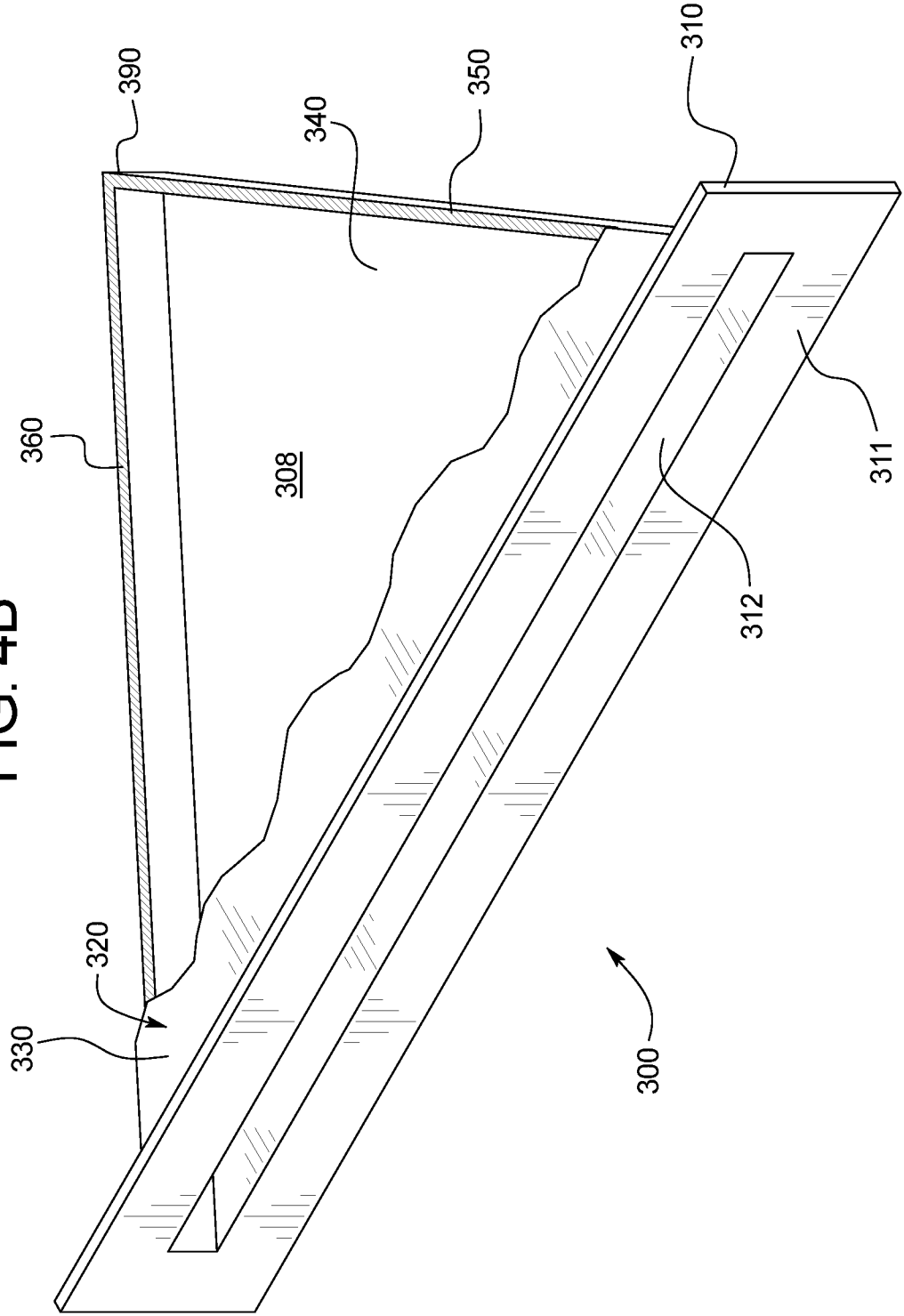
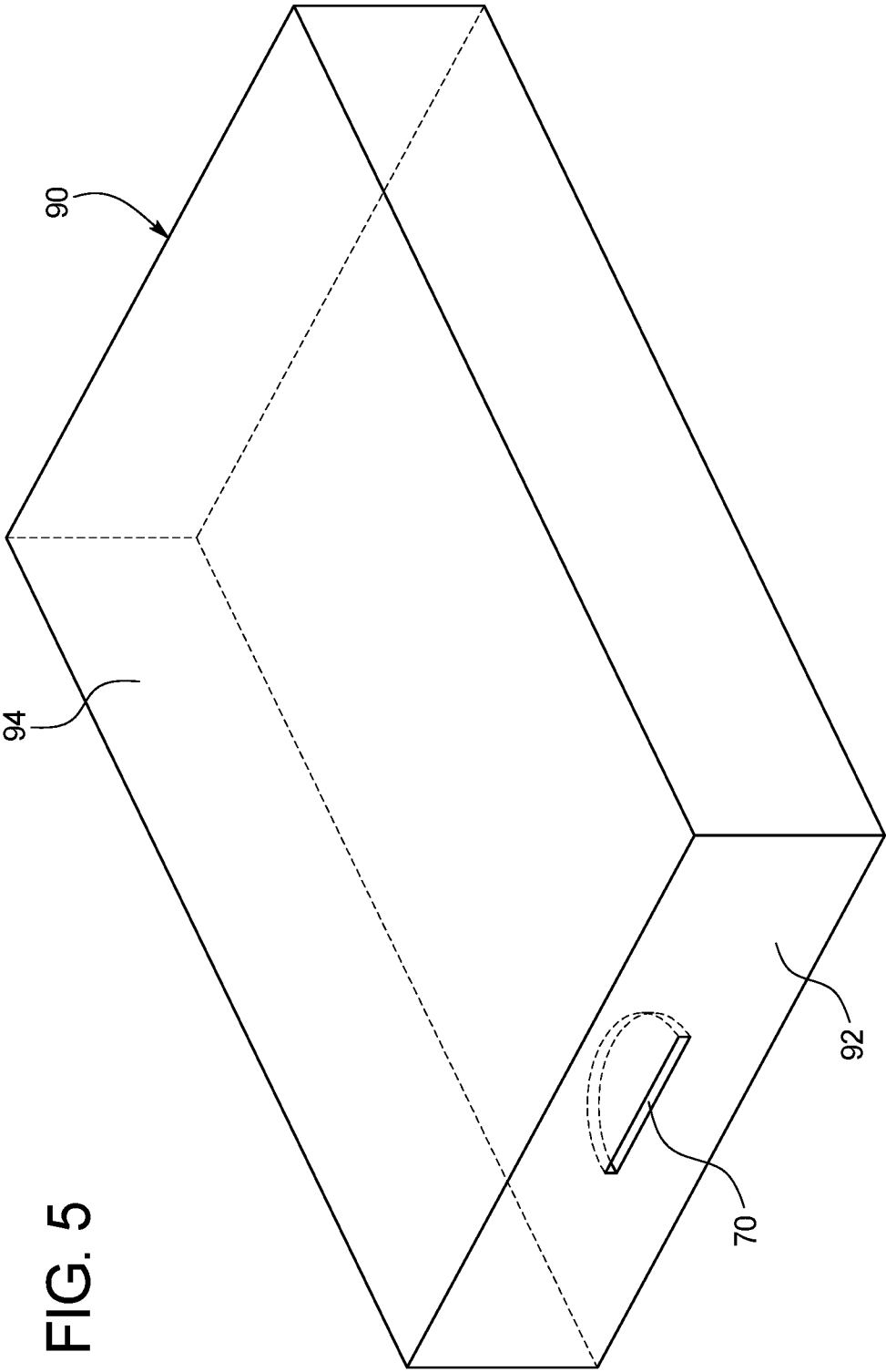


FIG. 4B





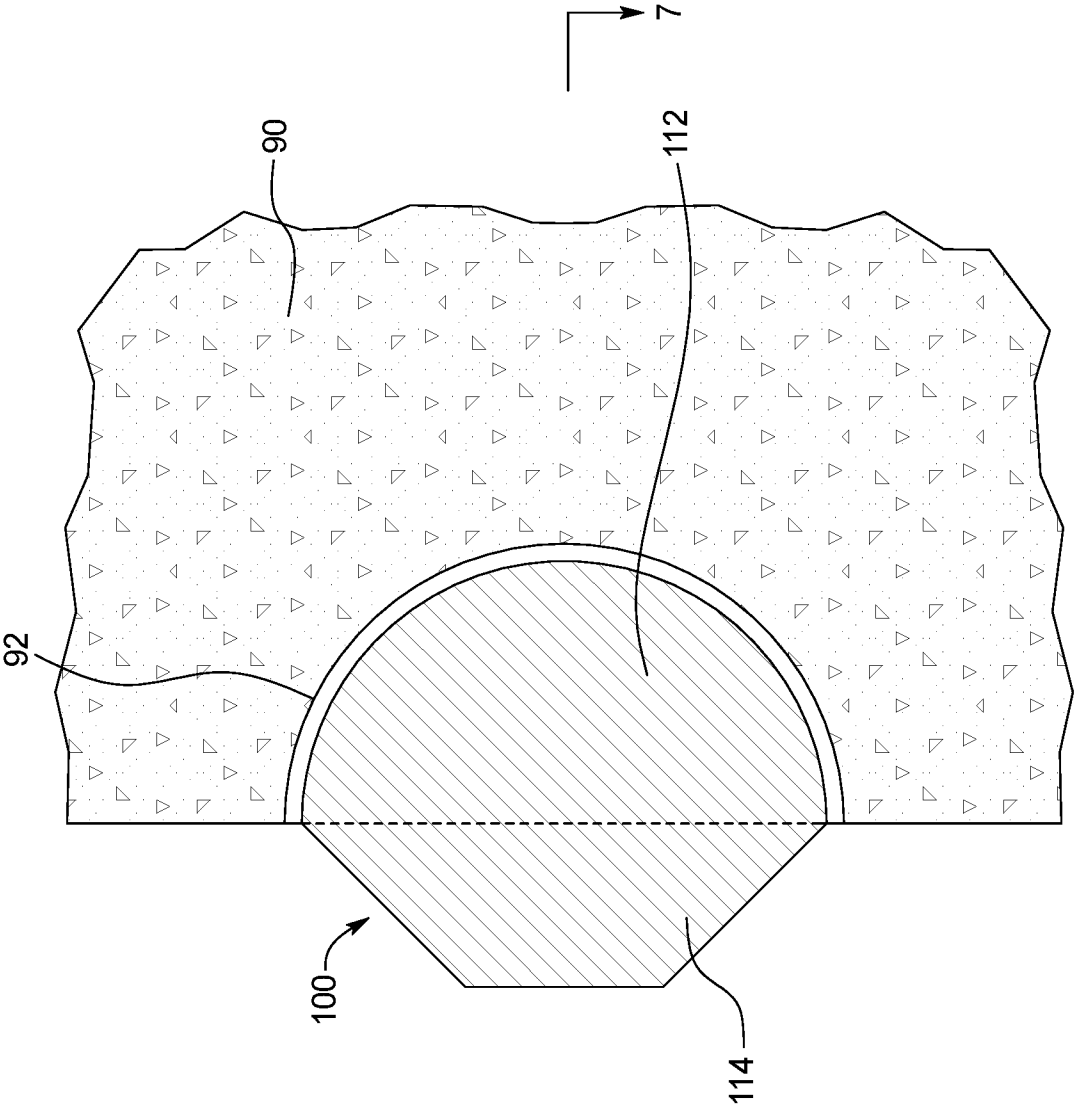
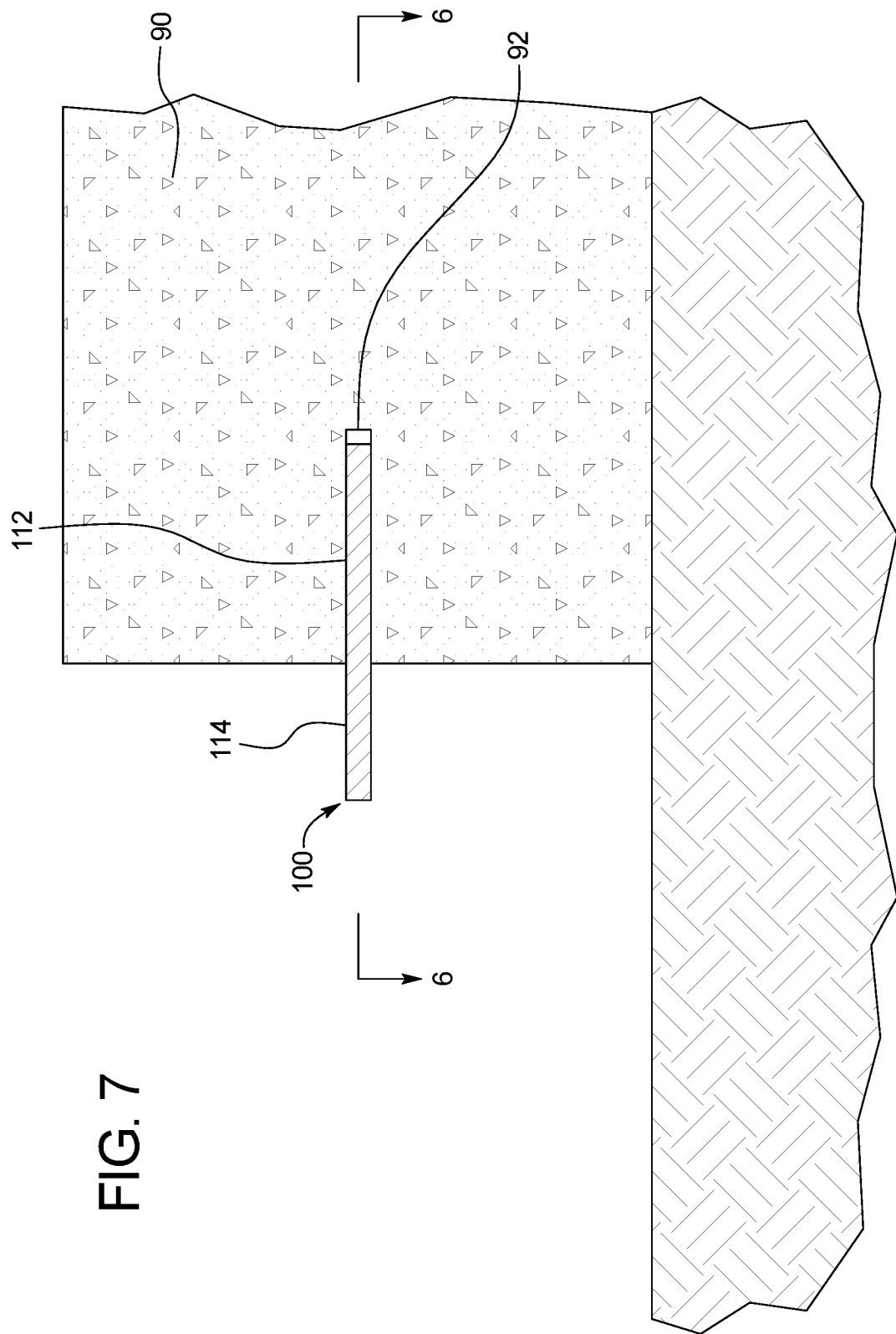


FIG. 6



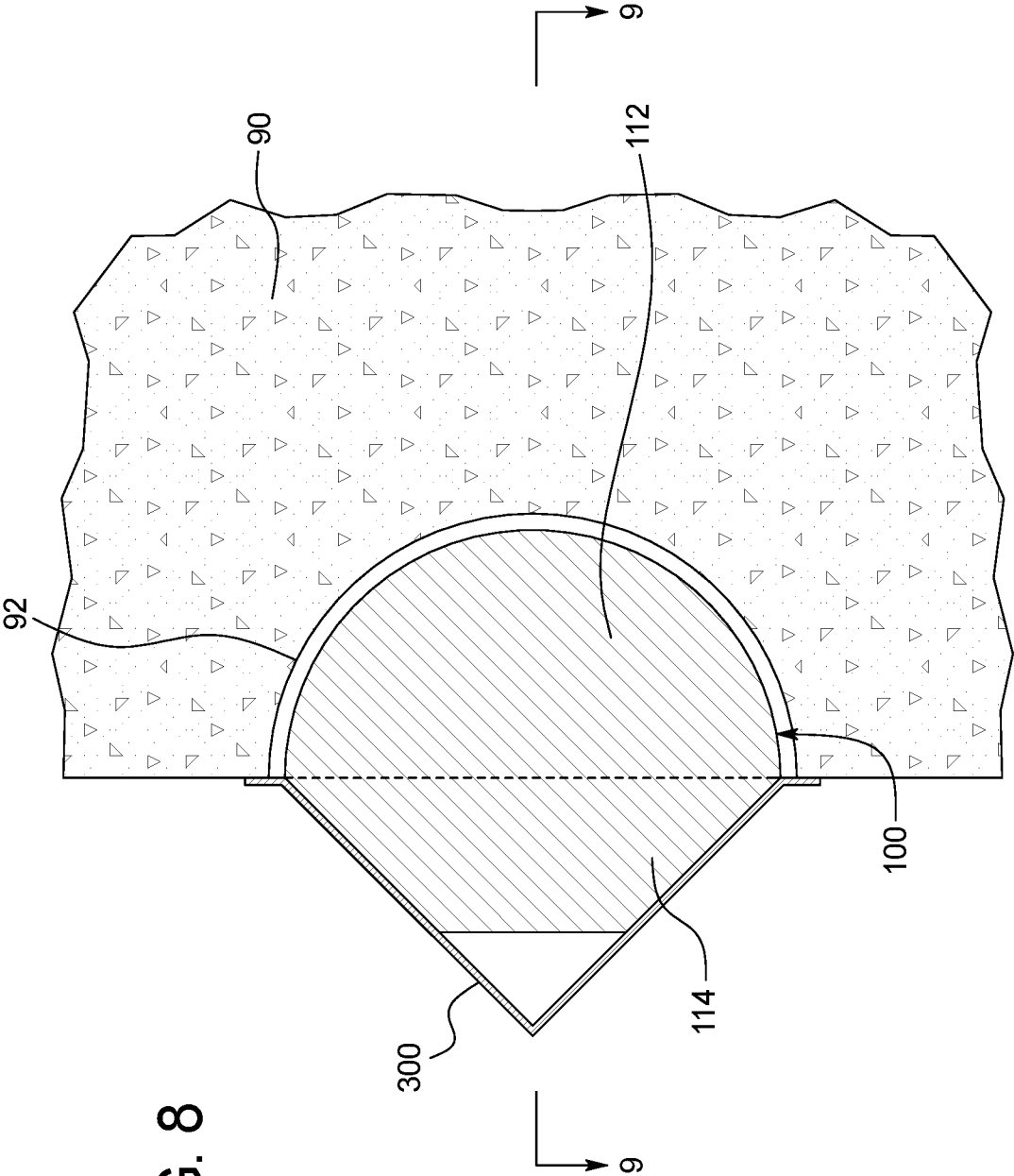


FIG. 8

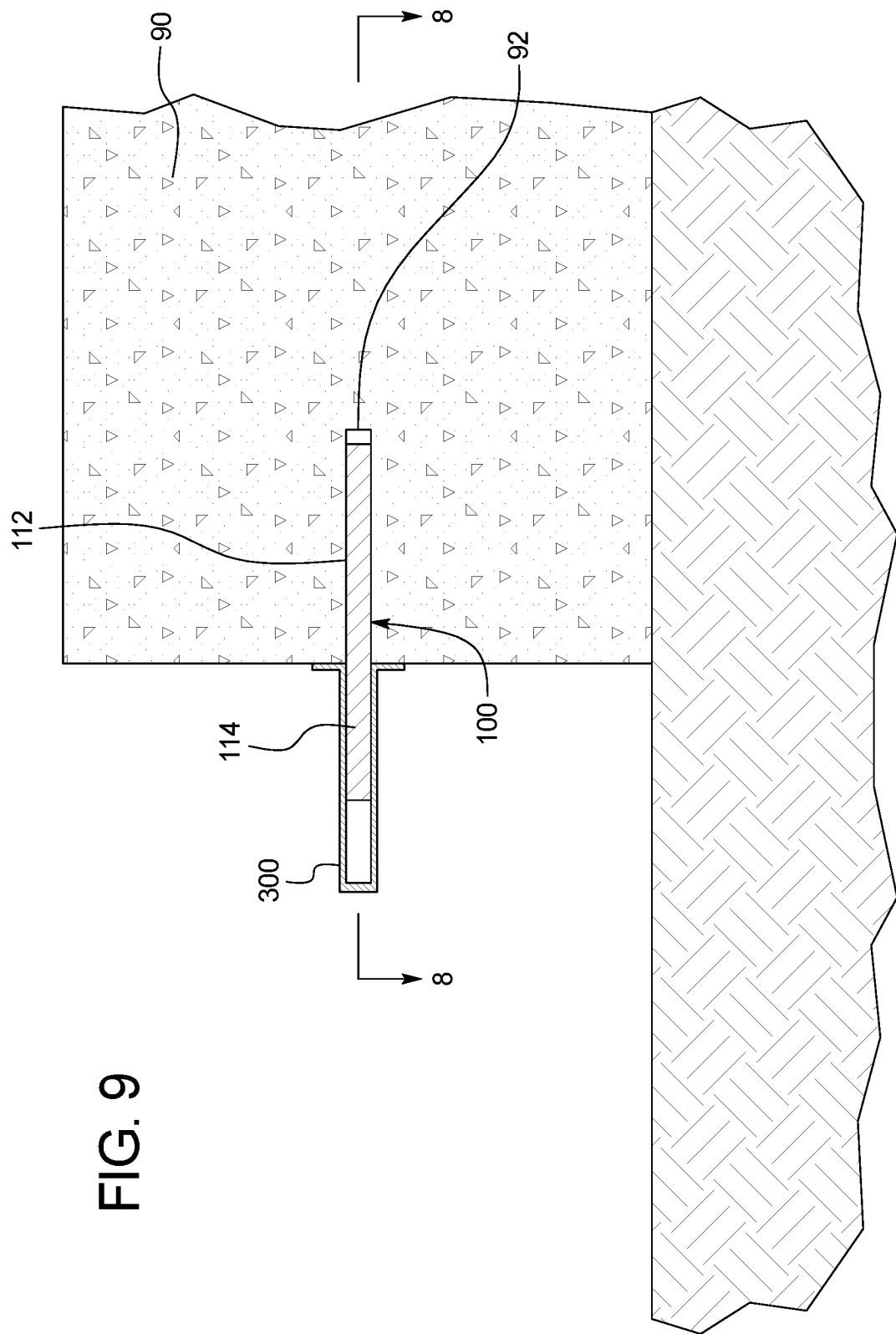
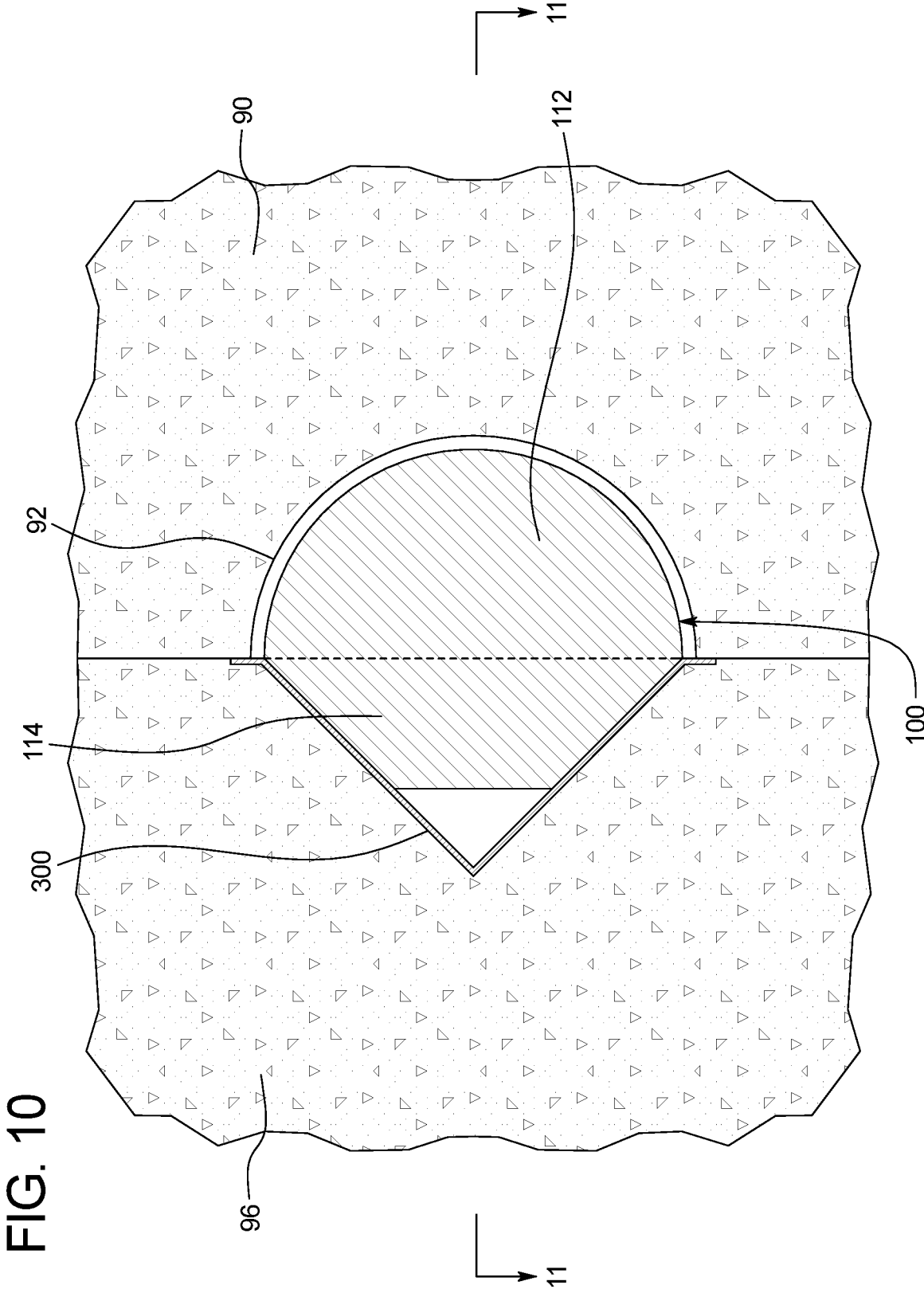


FIG. 9



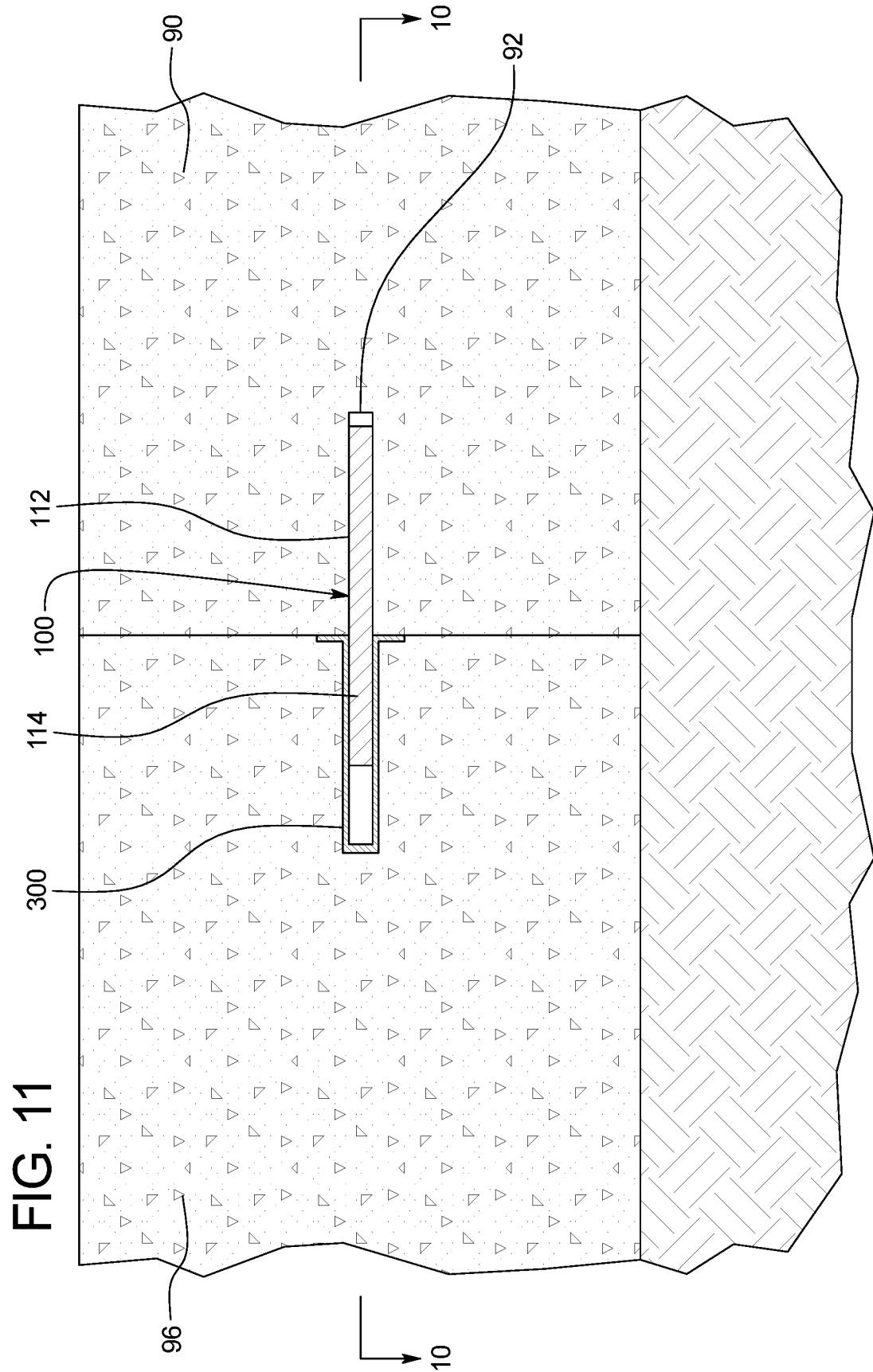


FIG. 12A

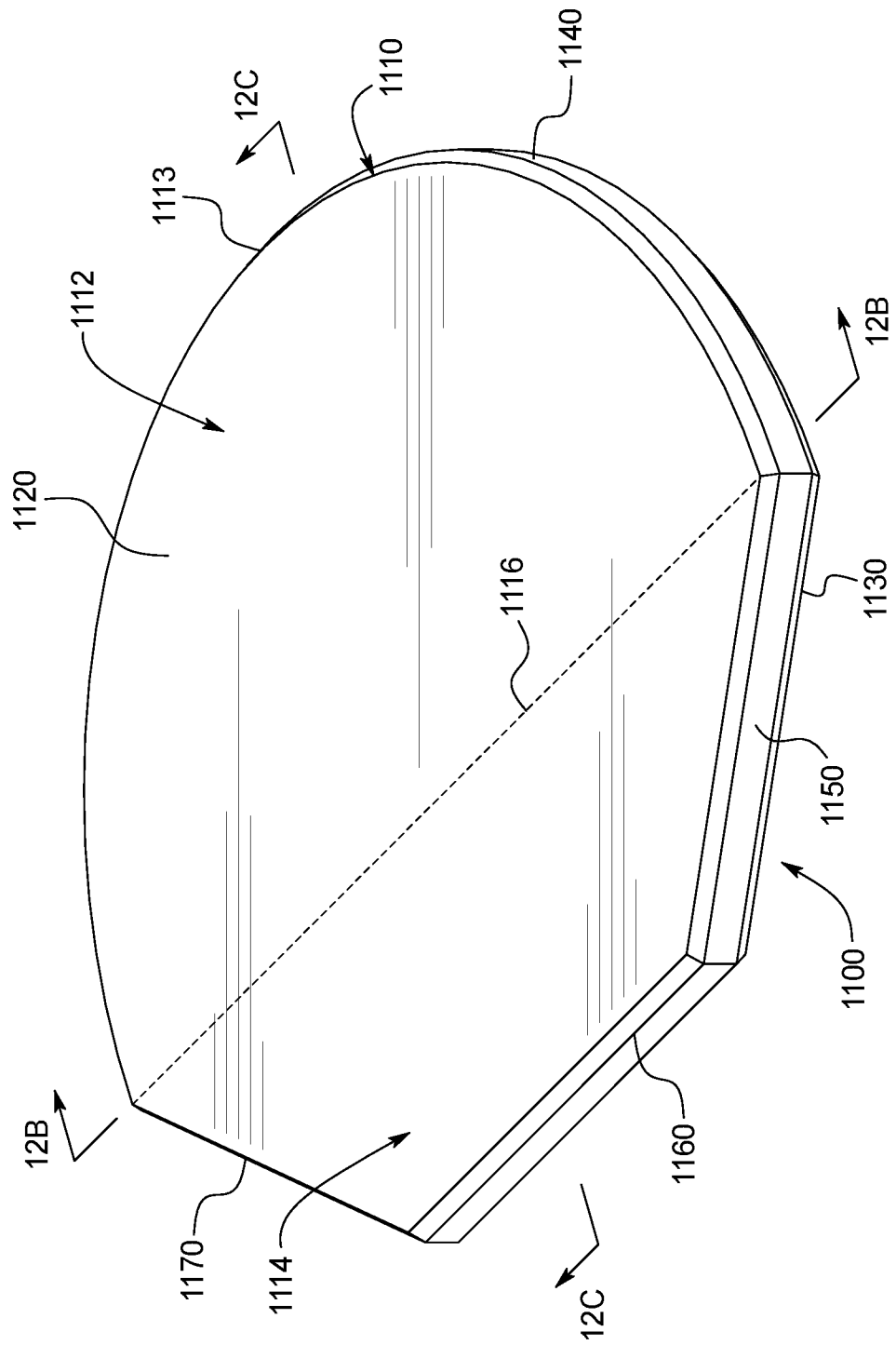


FIG. 12B

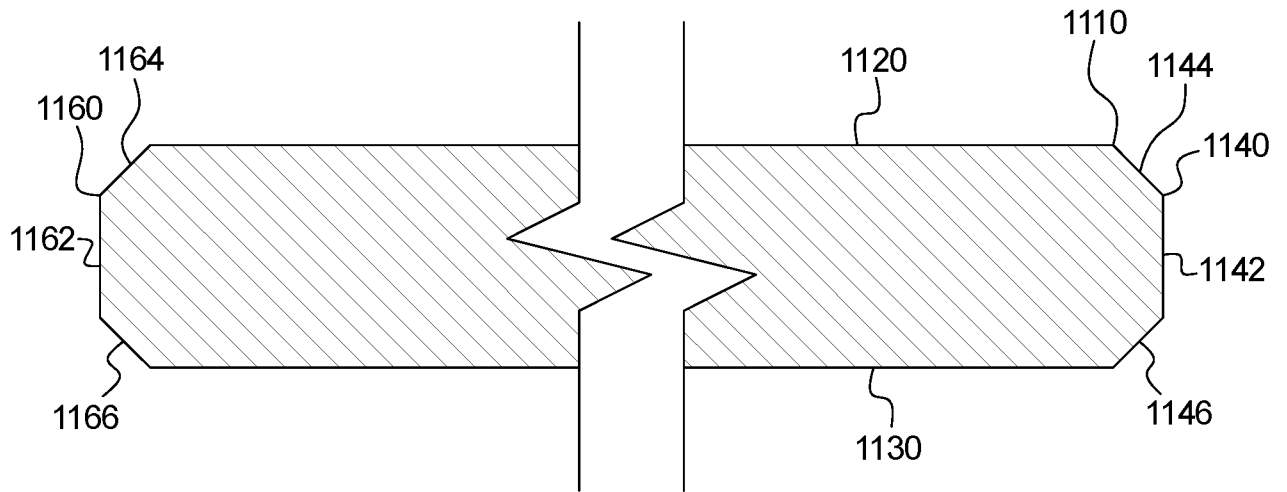


FIG. 12C

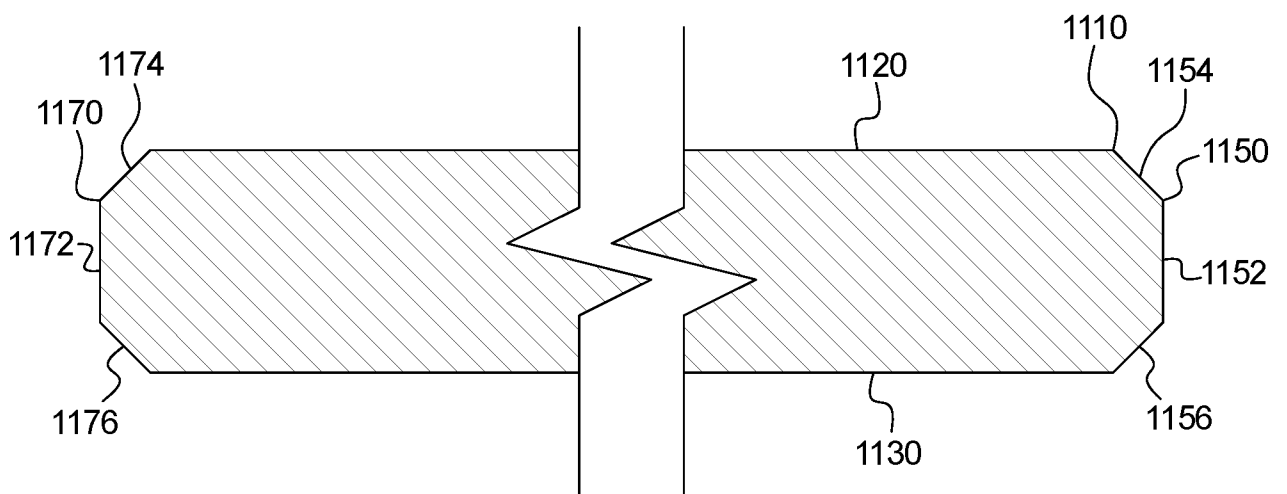


FIG. 13

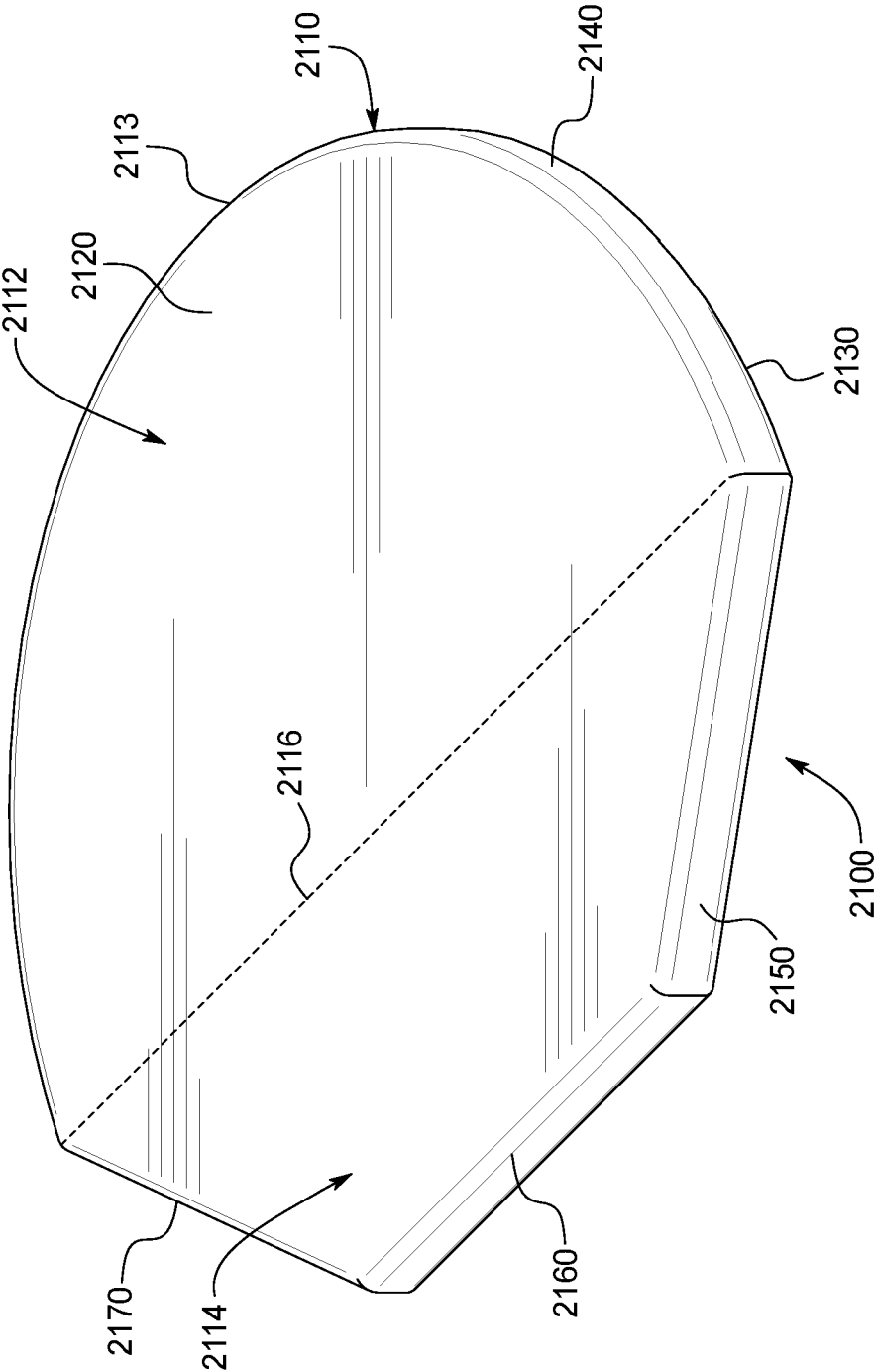
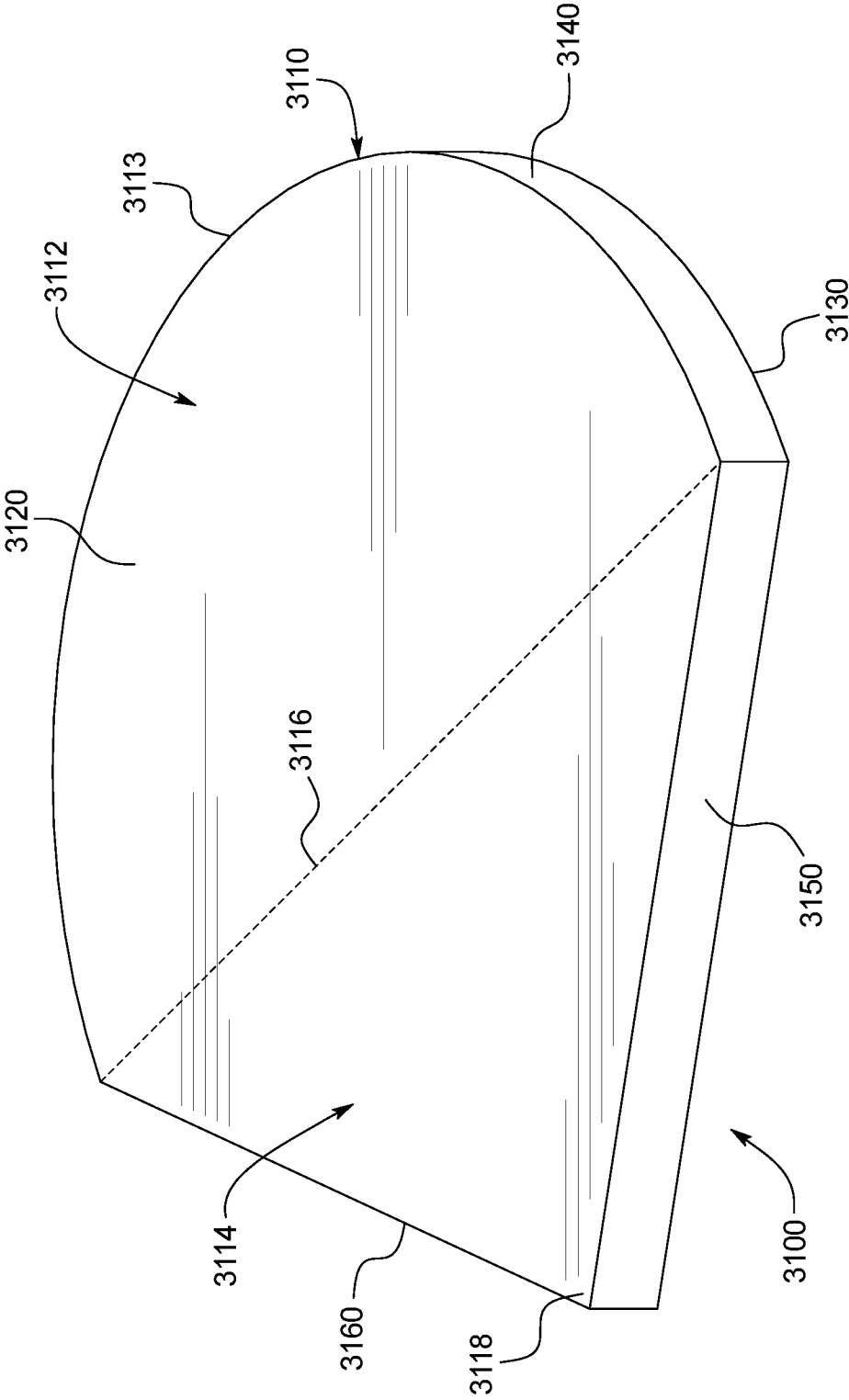


FIG. 14



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/065028

A. CLASSIFICATION OF SUBJECT MATTER
INV. E01C11/14 E04B1/48
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E01C E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/123176 A1 (DEVLIN SEAMUS MICHAEL [GB]) 23 November 2006 (2006-11-23)	3-7
Y	figures 20-34 page 10, line 24 - page 12, line 25 the whole document	8
Y	----- US 8 356 955 B2 (P N A CONSTRUCTION TECHNOLOGIES INC [US]; NADLER DONALD S [US]) 22 January 2013 (2013-01-22) cited in the application figures 1-4 the whole document	8
A	----- US 2007/269266 A1 (KELLY DAVID L [US] ET AL) 22 November 2007 (2007-11-22) figures 1,2 the whole document ----- -/--	8



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

16 May 2018

Date of mailing of the international search report

25/05/2018

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Klein, A

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2017/065028

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 354 760 B1 (BOXALL RUSSELL [US] ET AL) 12 March 2002 (2002-03-12) cited in the application figures 1-23 the whole document	3-8
A	----- US 6 926 463 B2 (SHAW LEE A [US] ET AL) 9 August 2005 (2005-08-09) figures 1-5 the whole document -----	3-8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/065028

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 1, 2
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 1, 2

On 30-04-2018, pursuant to Article 17(2)(a)(ii) PCT, the applicant was invited to indicate the claims complying with the Article 6 PCT on the basis of which the search was to be carried out.

On 11-05-2018, the applicant replied that he "elected claims 3-8 as the basis of which the search should be carried out", which is understood as an appropriate answer to the invitation pursuant to Article 17(2)(a)(ii) PCT.

The search is therefore done, in accordance with Article 17(2)(a)(ii) PCT, on independent claim 3 and its dependent claims 4-7, and on independent claim 8.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2017/065028

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2006123176	A1	23-11-2006	NONE
US 8356955	B2	22-01-2013	US 2006127179 A1 15-06-2006 US 2009060655 A1 05-03-2009 US 2011225908 A1 22-09-2011 US 2013125484 A1 23-05-2013 US 2014053822 A1 27-02-2014
US 2007269266	A1	22-11-2007	NONE
US 6354760	B1	12-03-2002	AU 750868 B2 01-08-2002 CA 2311949 A1 24-06-1999 EP 1034340 A1 13-09-2000 NZ 504785 A 01-03-2002 US 6354760 B1 12-03-2002 WO 9931329 A1 24-06-1999
US 6926463	B2	09-08-2005	US 2005036835 A1 17-02-2005 US 2005214074 A1 29-09-2005 US 2006185286 A1 24-08-2006