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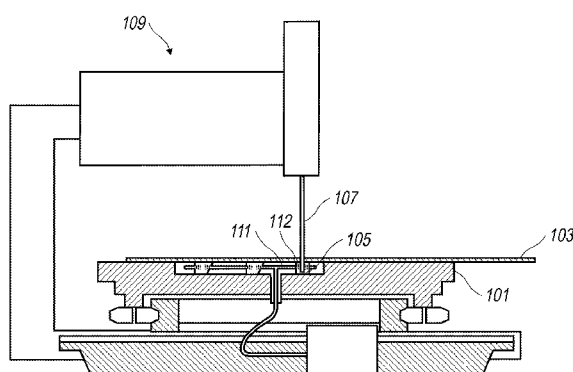


FIG. 1

(57) Abstract: A cutting machine (100) having a liquid lubrication delivery system includes: a work-piece platform (101) having an upper surface for supporting a work-piece (103) thereupon, a channel (105) establishing an open slot that receives a perimeter of a cutting blade (107) of the cutting machine (109) during cutting operations, and at least one liquid lubrication inlet (111) having a discharge opening (112) within said channel (105). The liquid lubrication inlet (111) is configured to promote flow of discharged lubricant in the channel (105) predominantly in one lengthwise direction. The liquid lubrication inlet (111) can also fluidly connect the channel (105) with at least one lubricant distribution manifold (113). A longitudinal axis of the lubrication inlet (111) can also be oriented at an angle to the longitudinal axis of the channel (105). The liquid lubrication inlet (111) can be tapered from an inlet end to the discharge opening (112). There can also be a plurality of lubrication inlets (111) serially spaced lengthwise along the channel (105).



CUTTING MACHINE WITH A LIQUID LUBRICATION DELIVERY SYSTEM**FIELD OF THE INVENTION**

[0001] The invention relates to the field of cutting machines, and more particularly, to cutting machines including a liquid lubrication delivery system.

BACKGROUND OF THE INVENTION

[0002] Typical tile and masonry saws have cooling mechanisms because as the blade rotates and cuts through a piece of tile, the friction between the blade and the tile generates heat. Such heat can be damaging to the blade. Several solutions exist to solve this problem.

[0003] For example, there are tile saws that have a sub-surface basin filled with static coolant, such as water. In these saws, the blade extends into the basin and at least a portion of the blade's perimeter is always submerged in the water. When the tile saw is operated, the blade rotates in the water cooling the blade. Although heat damage is reduced by the cooling, part of the blade is always submerged in the water, which can be damaging.

[0004] Another type of tile saw with a cooling mechanism employs nozzles directed toward the top and/or sides of the cutting blade. In some saws, the nozzles are integrated with the blade guard housing. In other saws, the nozzles are positioned outside the blade guard but are directed at the blade from above the work-piece to be cut. Although these systems eliminate submersion of the blade in a water basin, a new problem of overspray arises. As the nozzles spray water against the rotating blade, water is splashed off the blade creating a mess in the work area and wetting the operator. Furthermore, this system wastes water because much of the water is splashed off of the blade before it can properly cool the blade.

[0005] To address this problem of overspray, splash guards, splash curtains, and guard houses with baffles have been employed to block or re-direct the overspray downwardly towards the work-piece. These solutions, however, still use more water than necessary to cool the blade

and provide dust control, along with leaving the top of the work-piece soaked. Additionally, debris and dust from cutting the work-piece can build up on the work table and on the cutting blade.

[0006] Therefore, there is a need for a cutting machine including a liquid lubrication delivery system that minimizes and controls liquid overspray and debris accumulation during operation, while also reducing the amount of liquid needed to properly cool and lubricate the cutting blade.

SUMMARY OF THE INVENTION

[0007] The present disclosure is directed to a cutting machine having a liquid lubrication delivery system. This cutting machine having a liquid lubrication delivery system contains and controls liquid lubricant to efficiently cool, lubricate, and remove debris from a cutting blade.

[0008] One embodiment takes the form of a cutting machine having a liquid lubrication delivery system that includes a work-piece platform having a channel establishing an elongate recessed space in the upper surface of the work-piece platform. A perimeter of a cutting blade of the cutting machine can be received in the channel during cutting operations. There is at least one liquid lubrication inlet having a discharge within the channel. The liquid lubrication inlet is configured to promote flow of discharged lubricant from a liquid source in the channel predominantly in one lengthwise direction from a liquid source. Liquid from the liquid source is transferred to the channel by a lubricant distribution manifold via the liquid lubrication inlets.

[0009] Each liquid lubrication inlet has an inlet end open to the lubricant distribution manifold and a discharge opening open to the channel. The configuration of the inlets along the channel fosters sufficient flow speed of liquid within the channel to provide an adequate sweeping flow that removes debris from the channel and cools the cutting blade. In an exemplary embodiment, the lubrication inlets are tapered, positioned at an angle to the longitudinal axis of the channel, and serially spaced lengthwise along the channel. Such configuration pressurizes lubrication liquid as it passes through an inlet and causes it to contact

the opposing wall of the channel upon exit. This disperses the liquid to fill the channel. Because the liquid is pressurized and constantly flowing through the inlets, a resulting river of liquid flows through the channel and out an open end at a downstream end. Also, because of this arrangement, the liquid only flows in one lengthwise direction down the channel.

[0010] This cutting machine having a liquid lubrication delivery system maintains a relatively constant level and velocity of flowing liquid lubricant in the channel to cool a cutting blade or grinding blade and to remove any dust or debris that accumulates on the cutting blade or within the channel. Also, this cutting machine minimizes the overspray typically associated with cutting tools employing lubrication delivery systems. As a result, the cutting machine described herein having a liquid lubrication delivery system provides a more compact cutting machine that effectively and efficiently cools a cutting blade and controls liquid lubricant delivery to the cutting blade without creating a mess in the work area or wetting the operator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The foregoing features of the invention will be more readily understood by reference to the following detailed description, taken with reference to the accompanying drawings, in which:

[0012] FIG. 1 is a front view of one embodiment of a cutting machine including a liquid lubrication delivery system configured according to the teachings of this disclosure.

[0013] FIG. 2 is a cross-sectional perspective view of the work-piece platform of one embodiment of a cutting machine including a liquid lubrication delivery system.

[0014] FIG. 3 is another cross-sectional perspective view of the work-piece platform of FIG. 2 but further including a liquid lubrication delivery system having a perimeter of a cutting blade having a perimeter thereof received in the channel.

[0015] FIG. 4 is a cross-sectional front view of one embodiment of the work-piece platform and lubricant distribution manifold of a cutting machine including a liquid lubrication delivery system showing a perimeter of the cutting blade of the cutting machine received in the channel.

[0016] FIG. 5 is a perspective view of a portion of the work-piece platform of FIG. 6 showing a channel connected to two lubricant distribution manifolds.

[0017] FIG. 6 is a perspective view of the work-piece platform of an embodiment of the cutting machine including a liquid lubrication delivery system having three channels, one of which is connected to two lubricant distribution manifolds.

[0018] FIG. 7 is perspective view of the work-piece platform of FIG. 6 showing the lubricant distribution manifold covered by a manifold cover.

[0019] FIG. 8 is perspective view of another embodiment of the cutting machine including a liquid lubrication delivery system that additionally includes an upper liquid lubrication distribution system that discharges lubricant onto the cutting blade at a location above the work-piece platform.

[0020] FIG. 9 is a perspective view of another embodiment of the work-piece platform of a cutting machine including a liquid lubrication delivery system in which a lubricant distribution manifold is connected to two channels.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] A cutting machine having a liquid lubrication delivery system configured according to the present teachings will hereinafter be described more fully with reference to the accompanying drawings in which preferred embodiments of the system are illustrated. This system can, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this

disclosure will be thorough and complete, and will fully convey the scope of the invention to those persons skilled in the art. In the figures and description, like reference numbers refer to like elements throughout.

[0022] Referring to FIG. 1, a cutting machine 109 is shown having a liquid lubrication delivery system including a work-piece platform 101, a channel 105 recessed in an upper surface of the work-piece platform 101 and which receives a perimeter of a cutting blade 107 of the cutting machine 109. Liquid lubrication inlets 111 having discharge openings 112 into the channel 105 are also depicted. The platform 101 is shown having an upper surface for supporting a work-piece 103 thereupon. Such a work-piece 103 can be of a sheet-type such as the case with ceramic tile, clay tile, stone, marble, or other similar sheet-type material. The work-piece 103 can also be of non-sheet-type material such as bricks, pavers, or the like.

[0023] The channel 105 establishes an elongate recessed space into the upper surface of the platform 101. The channel 105 is open and forms an open slot that is deep enough to receive a perimeter of the cutting blade 107 of the cutting machine 109 during cutting operations. At least one liquid lubrication inlet 111 has a discharge opening 112 that opens into channel 105. The liquid lubrication inlet 111 is configured to promote flow of discharged lubricant in the channel 105 predominantly in one lengthwise direction of the channel 105. Those skilled in the art will note that more than one liquid lubrication inlet 111 can be used as seen in FIGS. 4 and 5. Also, the channel 105 must be sufficiently wide and deep to accommodate the prescribed volume of liquid being delivered from the liquid lubrication inlet 111 but narrow and shallow enough to maintain a steady flow and velocity of delivered liquid within the channel 105.

[0024] As shown in FIGS. 2, 3, and 5, the liquid lubrication inlets 111 are fluidly connected to at least one lubricant distribution manifold 113. The lubricant distribution manifold 113 fluidly connects the channel 105 with a liquid source. Liquid from the liquid source, such as a basin, faucet, reservoir, or the like is transferred to the channel 105 by the lubricant distribution manifold 113 via the liquid lubrication inlets 111. Each liquid lubrication inlet 111 has an inlet end 117 open to the lubricant distribution manifold 113 and a discharge opening 112 open to the channel 105. It will be appreciated that more than one lubricant distribution manifold 113 can be

used to deliver liquid from the liquid source to the channel 105. For instance, in FIGS. 2 and 3, two lubricant distribution manifolds 113 are shown fluidly connected to the channel 105, one on each side of the channel 105, by liquid lubrication inlets 111.

[0025] FIGS. 5 and 9 provide more detailed views of exemplary lubricant distribution manifolds 113. In the depicted embodiments, a manifold 113 is positioned on each side of and parallel to the channels 105. At one end of the manifold 113 is an entry point 116 through which liquid from a liquid source enters. Multiple liquid lubrication inlets 111 fluidly connect each manifold 113 to a channel 105. The inlets 111 can be of uniform longitudinal shapes but can also be tapered as shown in FIG. 5. For example, the inlet can be tapered from the inlet end 117 to the discharge opening 112. The inlets 111 can also be oriented such that the longitudinal axis of each inlet 111 is oriented at an angle to the longitudinal axis of the channel 105. As liquid continuously enters the manifold 113, the liquid is forced through the inlets 111 into the channel 105. The velocity and direction of flow in the channel 105 is determined at least in part by the shape, size, width, and orientation of the inlets 111.

[0026] If more than one manifold 113 with multiple lubrication inlets 111 are used, it is not necessary that the same number of inlets 111 connect each manifold 113 to the channel 105. For example, one manifold 113 can be connected to the channel 105 by four inlets 111, while the second manifold can be connected to the channel 105 by three inlets 111. Similarly, the inlets 111 on one side of the channel 105 need not be directly opposite the inlets 111 on the opposite side of the channel 105. As depicted in FIG. 5, the inlets 111 are serially spaced apart lengthwise along the channel 105. Referring to FIG. 5, the direction of liquid flow is shown by the arrow at the top of the figure. Liquid travels through the channel 105 from the upstream end (closest to the bottom of the figure) to the downstream end (at the top of the figure). Threaded apertures and capped apertures are also shown to demonstrate how the liquid lubrication delivery system can be configured and attached to a cutting machine 109.

[0027] In a preferred embodiment, a lubrication inlet 111 is positioned close to an upstream end of the respective channel 105. Such positioning aids in thoroughly removing and flushing out any debris and dust that can build up in the channel 105 during cutting operations.

[0028] In another embodiment depicted in FIG. 7, the manifold can be covered by a manifold cover 115 to further prevent overspray and promote uniform and steady flow of liquid to and through the channel 105 of the liquid lubrication delivery system.

[0029] The manifold 113 can be attached to the work-piece platform 101 in different ways. For example, the manifold 113 can be machined as a separate piece and bolted onto the work-piece platform 101. In this way, the work-piece platform 101 can be interchanged with a platform that does not include the above described liquid lubrication delivery system. Alternatively, the manifold 113 can be cast into the work-piece platform 101.

[0030] FIGS. 4, 6, 7, and 9 show a liquid lubrication delivery system having more than one channel 105 recessed at the upper surface of the work-piece platform 101. The additional channels 105 can be used for different types of cuts, such as miter cuts, bevel cuts, plunge cuts, or others. Each of these channels 105 include lubrication inlets 111 connected to manifolds 113. Additionally, FIG. 9 depicts how the previously described manifolds 113 can be configured and attached to a liquid lubrication delivery system having multiple channels 105. Still referring to FIG. 9, two channels 105 are each connected to two lubricant distribution manifolds 113, but the channels 105 share a distribution manifold 113.

[0031] FIG. 8 depicts another embodiment of a cutting machine 109 having a liquid lubrication delivery system. In this embodiment, the system additionally includes an upper liquid lubrication distribution system 110 positioned above the work-piece platform 101 such that it discharges lubricating liquid directly onto the cutting blade 107 at a location above the work-piece platform 101. This embodiment can also include a valve 114 fluidly connected between the liquid lubrication inlet 111 and the upper liquid lubrication distribution system 110. Such valve 114 can be used to allow the operator to dispense liquid lubrication to the channel 105 or the upper liquid lubrication distribution system 110 or to both the upper liquid distribution system 110 and the channel 105.

[0032] In another embodiment of the cutting machine 109 having a liquid lubrication delivery system, the work-piece platform 101 can be stationary or fixed and the cutting machine 109 moves relative thereto as an operator guides the cutting machine 109 to travel across the work-piece platform 101. Alternatively, the work-piece platform 101 can be moveable with respect to the cutting machine 109 such that the cutting machine 109 remains stationary and the operator moves the work-piece platform 101 relative the cutting machine 109. Or, the work-piece platform 101 and the cutting tool can be fixed in relation to each other such that the operator rests the work-piece 103 on top of the work-piece platform 101 and feeds the work-piece 103 towards the cutting blade 107 of the cutting machine 109.

[0033] In a further embodiment, the work-piece platform 101 can have a backstop 118 on which an edge of a work-piece 103 rests. This provides guidance and resistance to the operator as he moves the work-piece 103 against the cutting blade 107 to cut the work-piece 103.

[0034] In other embodiments, the cutting machine 109 can be a tile saw, a miter saw, a masonry saw, a circular saw, or the like. The cutting machine 109 can also be a grinding machine.

[0035] Additional attachments can also be used in conjunction with the above described cutting machine 109 having a liquid lubrication delivery system to further control and prevent overspray. Such attachments can include but are not limited to a blade guard surrounding the cutting blade, splash curtains, water pans, or splash guards.

[0036] Operation of the cutting machine 109 having a liquid lubrication delivery system will now be described with respect to delivering water to the cutting blade 107 of a tile saw. One skilled in the art will appreciate that the following discussion is only an exemplary use of the above described liquid lubrication delivery system. Any type of coolant or lubricant can be used instead of water, and any type of cutting tool or grinding tool can be used instead of a tile saw. Furthermore, operation will be described with respect to the embodiment depicted in FIGS. 1, 5, and 6 in which there is a manifold 113 on each lengthwise side of the channel 105 and there are a

plurality of tapered lubrication inlets 111 serially spaced lengthwise along and at an angle to the channel 105.

[0037] In operation, water is dispensed under pressure from a water source to the entry point 116 of the manifold 113 of the cutting machine 109 having a prescribed liquid lubrication delivery system. The water source can be integrated into the cutting machine 109 or can be separate. The manifold 113 is of an optimal width such that the water can be pushed through the inlets 111 into the channel 105 at a sufficient velocity. By virtue of fluid dynamics, the size, tapering, and orientation of the inlets 111 along the channel 105 foster sufficient flow speed therein to provide an adequate sweeping flow of water through the channel 105. In this exemplary embodiment, because the lubrication inlets 111 are tapered, positioned at an angle to the longitudinal axis of the channel 105, and serially spaced lengthwise along the channel 105, the pressurized water passes through an inlet 111 and contacts the opposing wall of the channel 105, thereby dispersing the water to fill the channel 105. Because the water is pressurized and constantly flowing through the inlets 111, a resulting river of water flows through the channel 105 and out an open end at the downstream end of the channel 105. Also, because of this arrangement, the water only flows in one lengthwise direction down the channel 105. Additionally, the channel 105 is dimensioned to contain the water within the channel 105 and to maintain a substantially constant depth and velocity of water flowing through the channel 105. When water is dispensed from a water source and moved into the channel 105, water will be flowing through the channel 105 before the cutting blade 107 enters the channel 105.

[0038] When the operator is ready to cut a piece of tile 103, he places the tile 103 on top of the work-piece platform 101 such that a back edge of the piece of tile 103 abuts the backstop 118 of the work-piece platform 101. The operator then guides the work-piece platform 101 and tile 103 towards the cutting blade 107. As the platform 101 moves closer to the blade 107, the river of water flowing at the downstream end of the channel 105 comes into contact with the blade 107 to begin cooling the blade. Then, as the tile 103 approaches the blade 107, the tile 103 is cut, and the river of water in the channel 106, which is now below the tile 103, flows across the blade 107 and continues to cool the blade 107 as the tile 103 is cut. Because the water is below the tile 103 and the lubrication inlets 111 are positioned to direct a constant flow of water

down the channel 105, water that would normally have been directed upwards and onto the tile 103 by the centrifugal force of the spinning blade 107 is diminished. Also, because the constant flow of water is in only one direction down the channel away from the operator, any water or overspray that would typically have been sprayed onto the operator and his work area is diminished. Dust or debris that results from cutting tile 103 is also reduced because the constant flow of water in the channel 105 takes on and pushes such dust and debris downstream of the channel 105 and out the open end of the channel 105.

[0039] With the cutting machine described above, liquid lubricant or coolant is contained in the channel 105 and maintained at a constant height and velocity, thereby efficiently cooling and lubricating the cutting blade 107, while minimizing overspray, debris build-up, and wasted liquid.

[0040] INDUSTRIAL APPLICABILITY: The present invention finds applicability in the power tool and industrial tool industries.

CLAIMS

What is claimed is:

1. A cutting machine (109) having a liquid lubrication delivery system, said machine comprising:
 - a work-piece platform (101) having an upper surface for supporting a work-piece (103) thereupon;
 - a channel (105) establishing an elongate recessed space into said upper surface, said recessed space being open at said upper surface thereby forming an open slot that receives a perimeter of a cutting blade (107) of said cutting machine (109) therein during cutting operations; and
 - at least one liquid lubrication inlet (111) having a discharge opening (112) within said channel (105), said at least one liquid lubrication inlet (111) configured to promote flow of discharged lubricant in said channel (105) predominantly in one lengthwise direction.
2. The cutting machine (109) as recited in claim 1, further comprising a plurality of channels (105), each forming an elongate recessed space into said upper surface and having at least one liquid lubrication inlet (111), said at least one liquid lubrication inlet (111) being fluidly connected to at least one lubricant distribution manifold (113).
3. The cutting machine (109) as recited in any one of claims 1-2, wherein the at least one liquid lubrication inlet (111) has a longitudinal axis oriented at an angle to a longitudinal axis of the channel (105).
4. The cutting machine (109) as recited in any one of claims 1-3, wherein the at least one liquid lubrication inlet (111) has an inlet end and is tapered from the inlet end to the discharge opening (112) thereof.

5. The cutting machine (109) as recited in any one of claims 1-4, wherein a plurality of liquid lubrication inlets (111) are positioned with at least one liquid lubrication inlet (111) on a first lateral side of the channel (105) and at least one liquid lubrication inlet (111) on an opposite second lateral side of the channel (105) with the discharge openings (112) of the liquid lubrication inlets (111) opening into the channel (105), and wherein the plurality of liquid lubrication inlets (111) fluidly connect the channel (105) with at least one lubricant distribution manifold (113).
6. The cutting machine (109) as recited in claim 5, wherein the discharge openings (112) of the plurality of liquid lubrication inlets (111) are serially spaced apart lengthwise along the channel (105).
7. The cutting machine as recited in any one of claims 2 or 5, wherein the at least one lubricant distribution manifold (113) is covered by a manifold cover (115).
8. The cutting machine (109) as recited in any one of claims 1-5, wherein one at least one of the channels has an upstream end and a downstream end.
9. The cutting machine (109) as recited in claim 8, wherein at least one of the liquid lubrication inlets (111) in the at least one of said channels (105) is close to the upstream end of the including respective channel (105).
10. The cutting machine (109) as recited in any one of claims 1-9, further comprising an upper liquid lubrication distribution system (110) positioned above the work-piece platform (101) and arranged to discharge lubricating fluid directly onto the cutting blade (107) at a location above the work-piece platform (101).
11. The cutting machine (109) as recited in claim 10, further comprising a valve (114) fluidly connected between the liquid lubrication inlet (111) and the upper liquid lubrication distribution system (110) whereby lubrication dispensation can be directed between channel distribution and distribution to the upper liquid lubrication distribution system (110).

12. The cutting machine (109) as recited in any one of claims 1-11, wherein the cutting machine (109) takes the form of a saw chosen from the group comprising: a tile-saw, a miter saw, a masonry saw, and a circular saw.

13. The cutting machine (109) as recited in any one of claims 1-12, wherein the upper surface of the work-piece platform (101) is configured for supporting a sheet-type work-piece (103).

14. A work-piece platform (101) for a cutting machine (109) comprising:

an upper surface for supporting a work-piece (103) thereupon;

a channel (105) establishing an elongate recessed space into said upper surface, said recessed space being open at said upper surface thereby forming an opening slot for receiving a perimeter of a cutting blade (107) of an incorporating cutting machine (109) therein during cutting operations; and

at least one liquid lubrication inlet (111) having a discharge opening (112) within said channel (105), said at least one liquid lubrication inlet (111) configured to promote flow of discharged lubricant in said channel (105) predominantly in one lengthwise direction, and wherein the liquid lubrication inlet (111) is configured to receive lubricant from a lubricant distribution manifold (113).

15. The work-piece platform (101) as recited in claim 14, wherein the upper surface of the work-piece platform (101) is configured for supporting a sheet-type work-piece (103).

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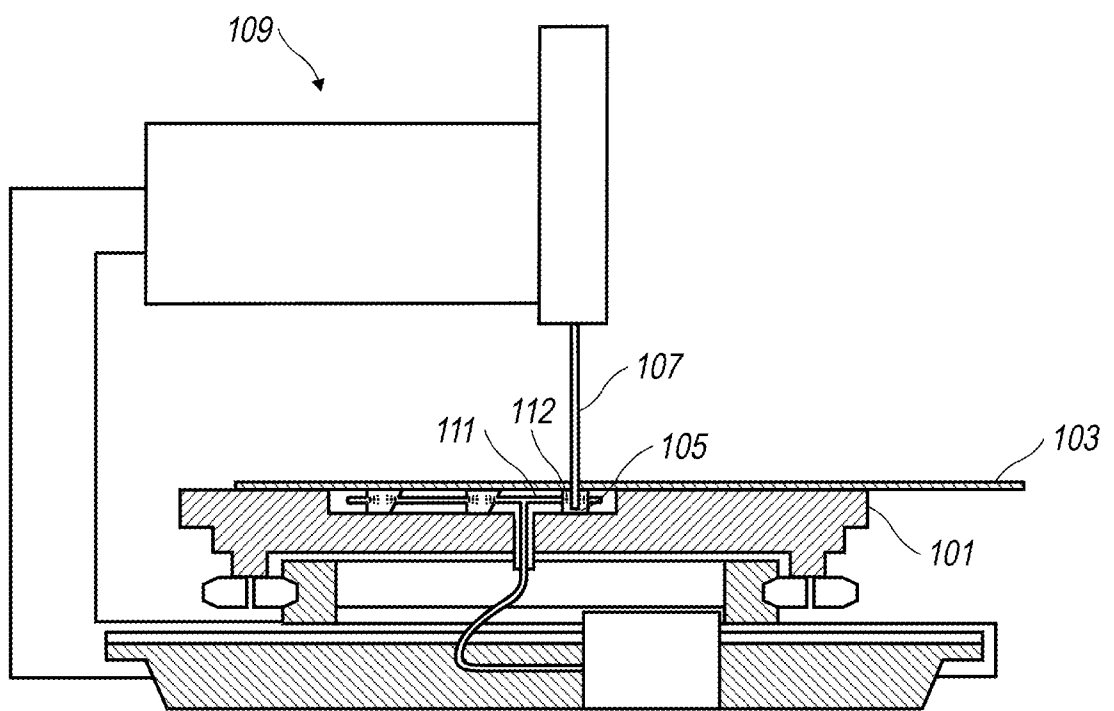


FIG. 1

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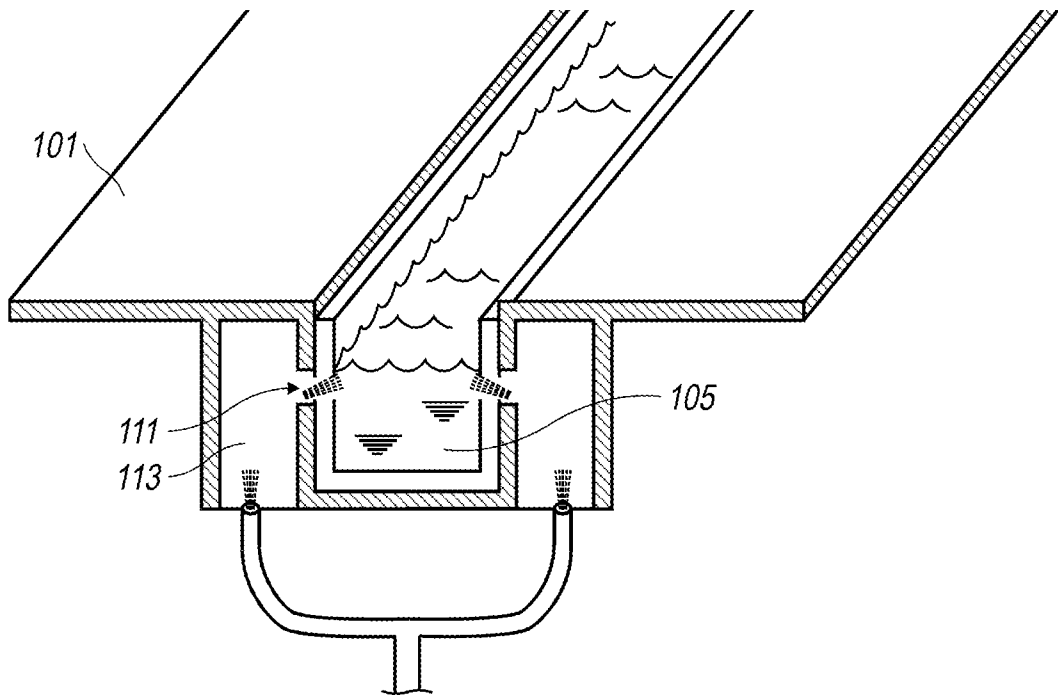


FIG. 2

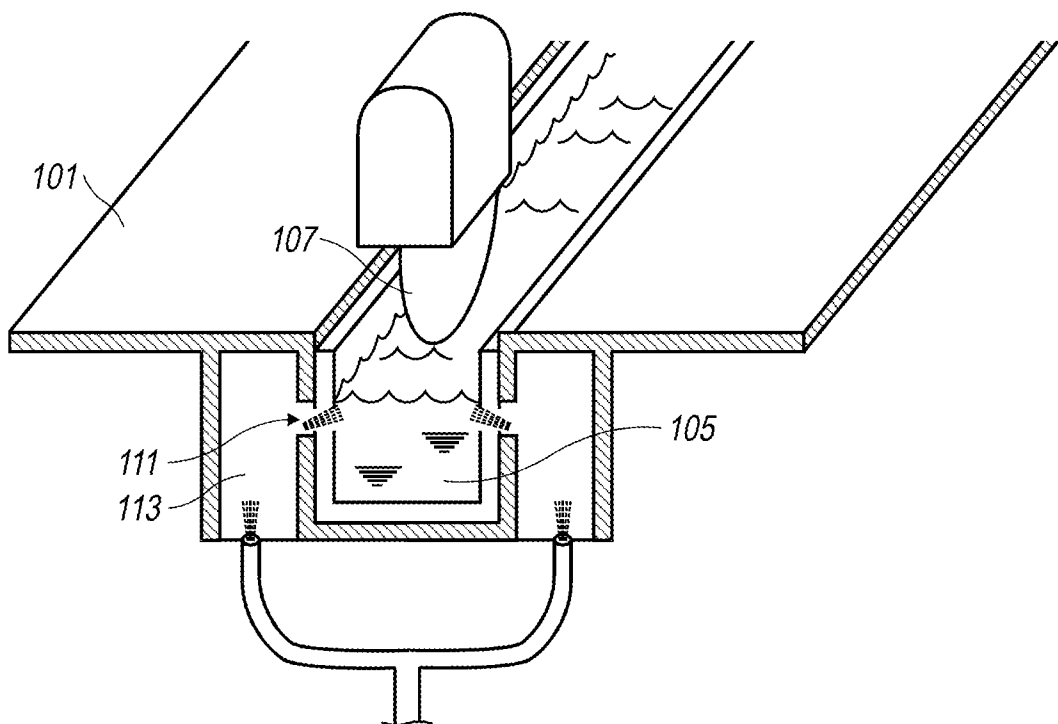


FIG. 3

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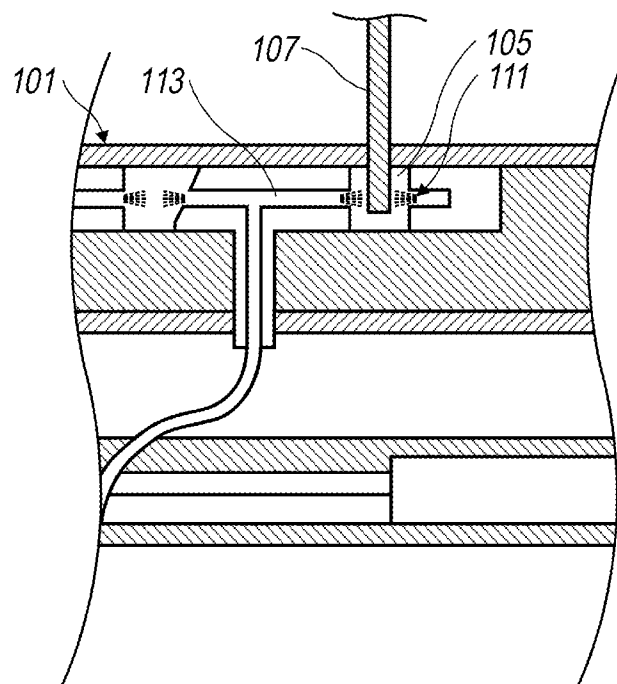


FIG. 4

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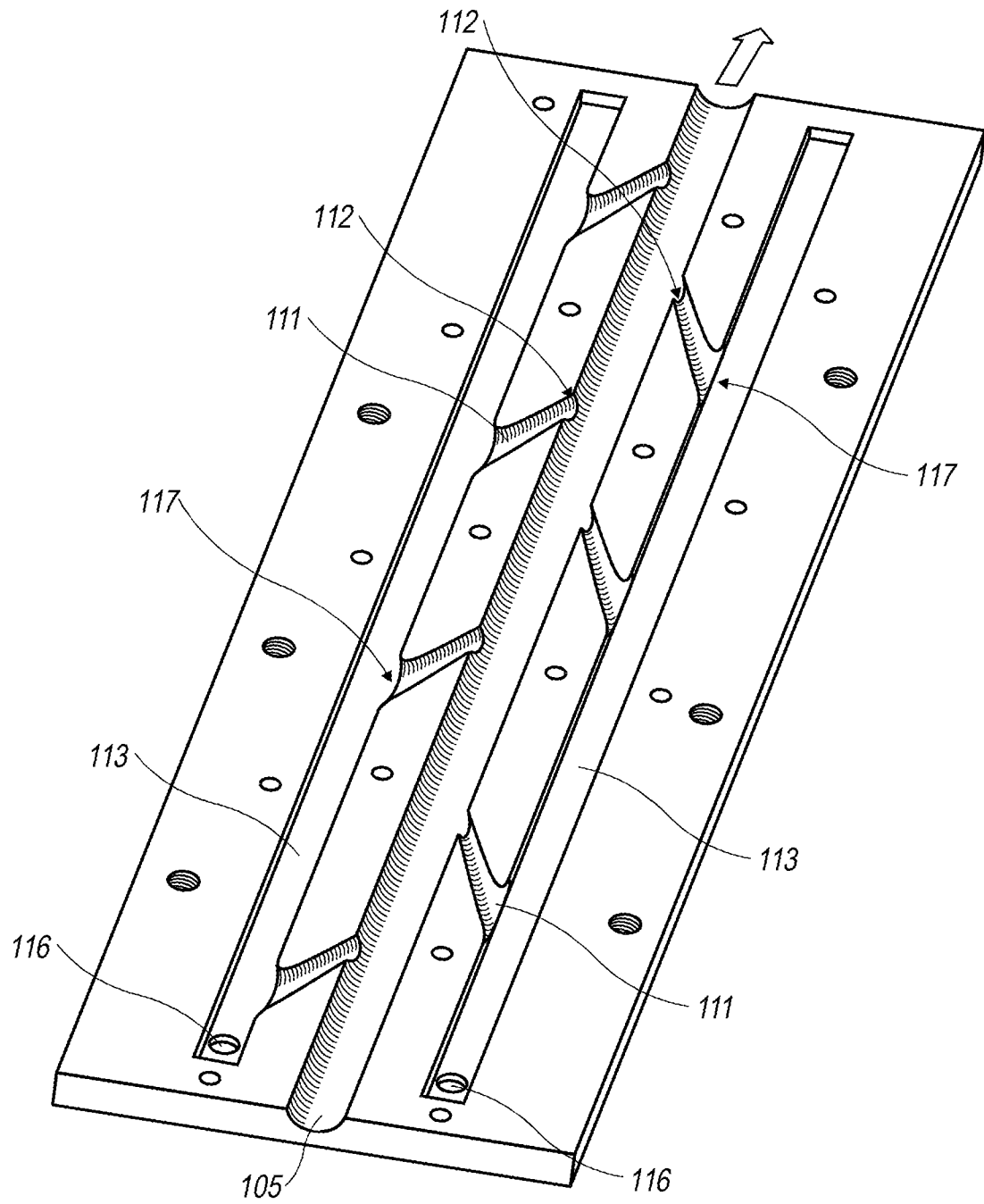


FIG. 5

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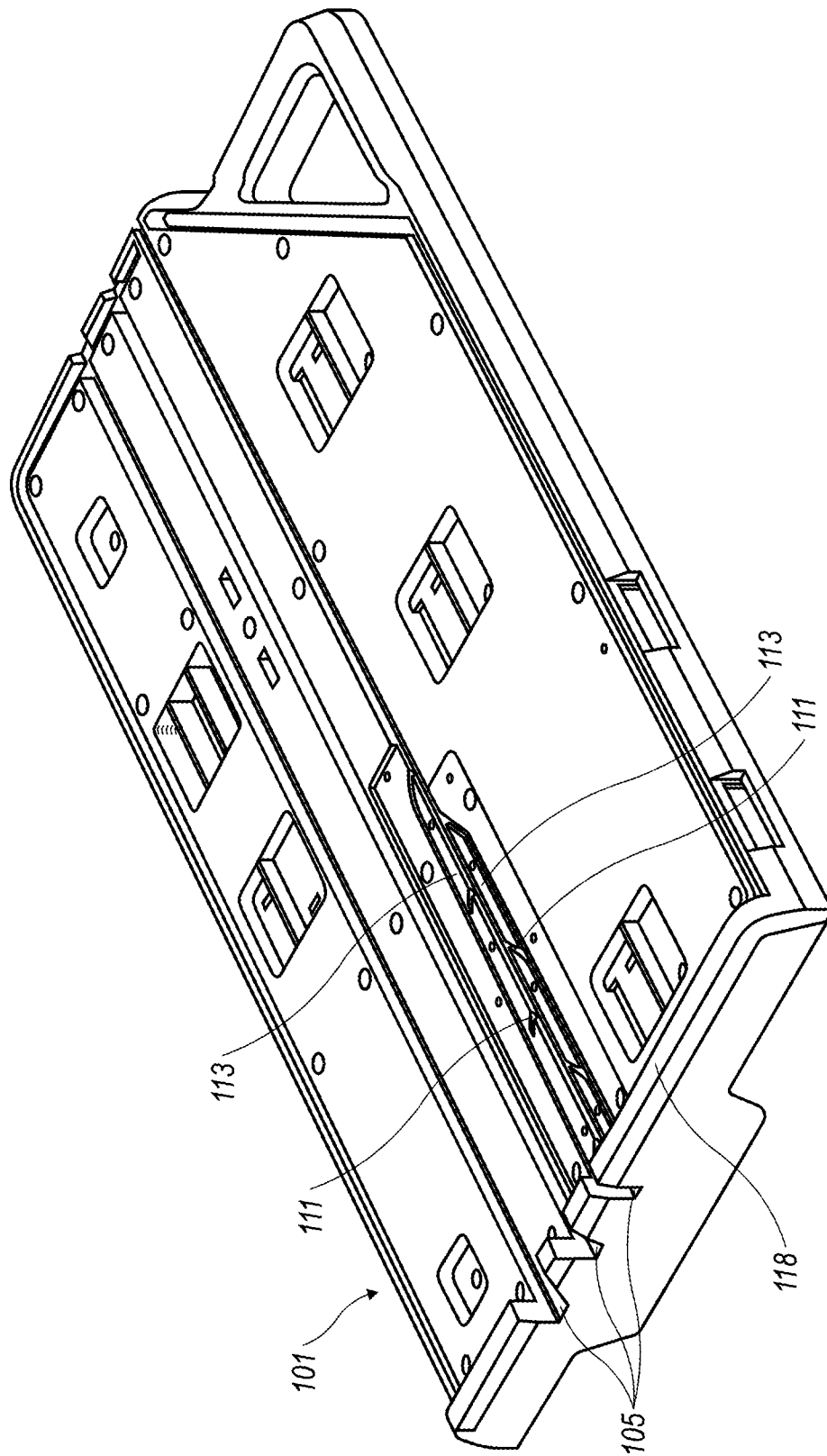


FIG. 6

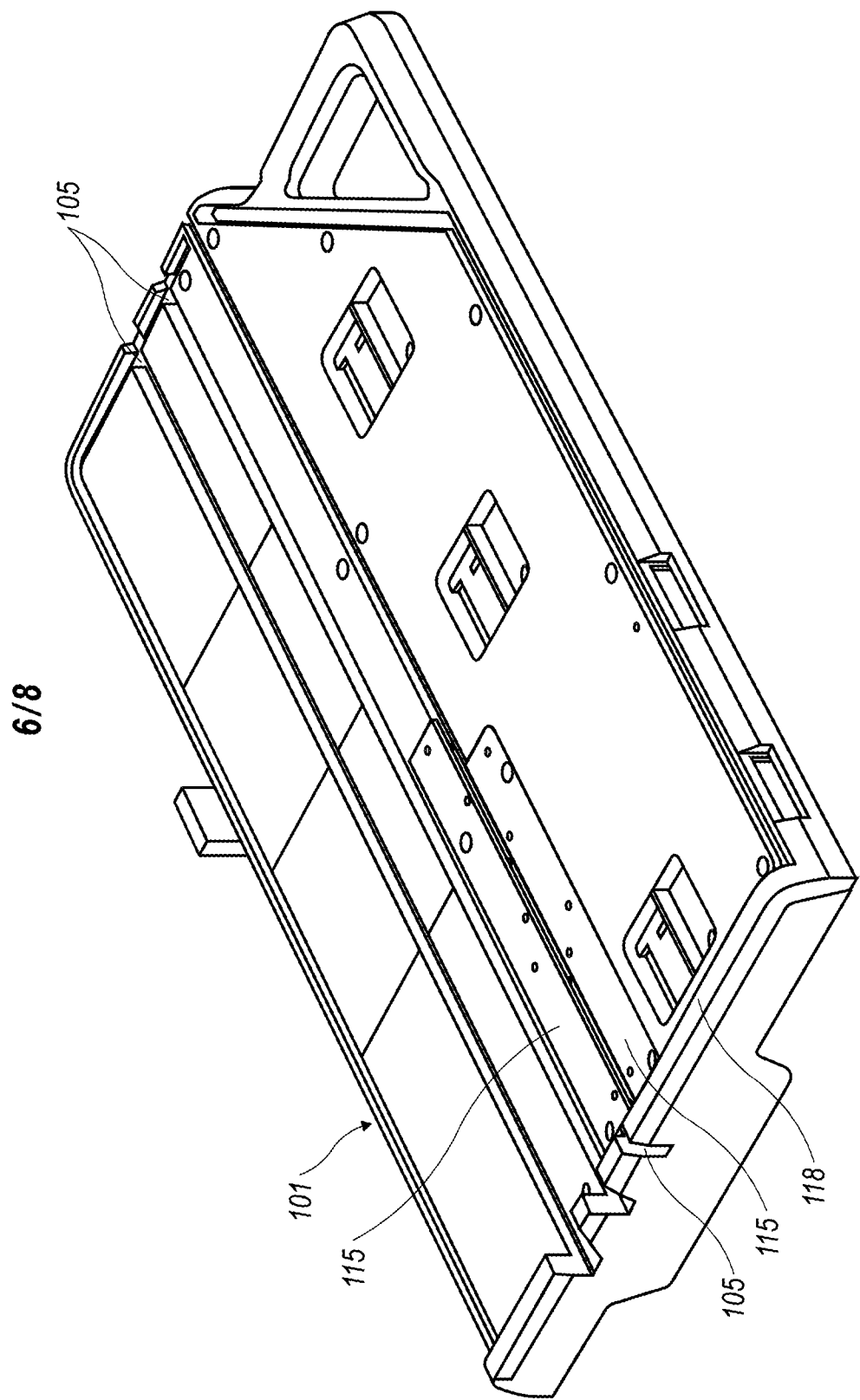


FIG. 7

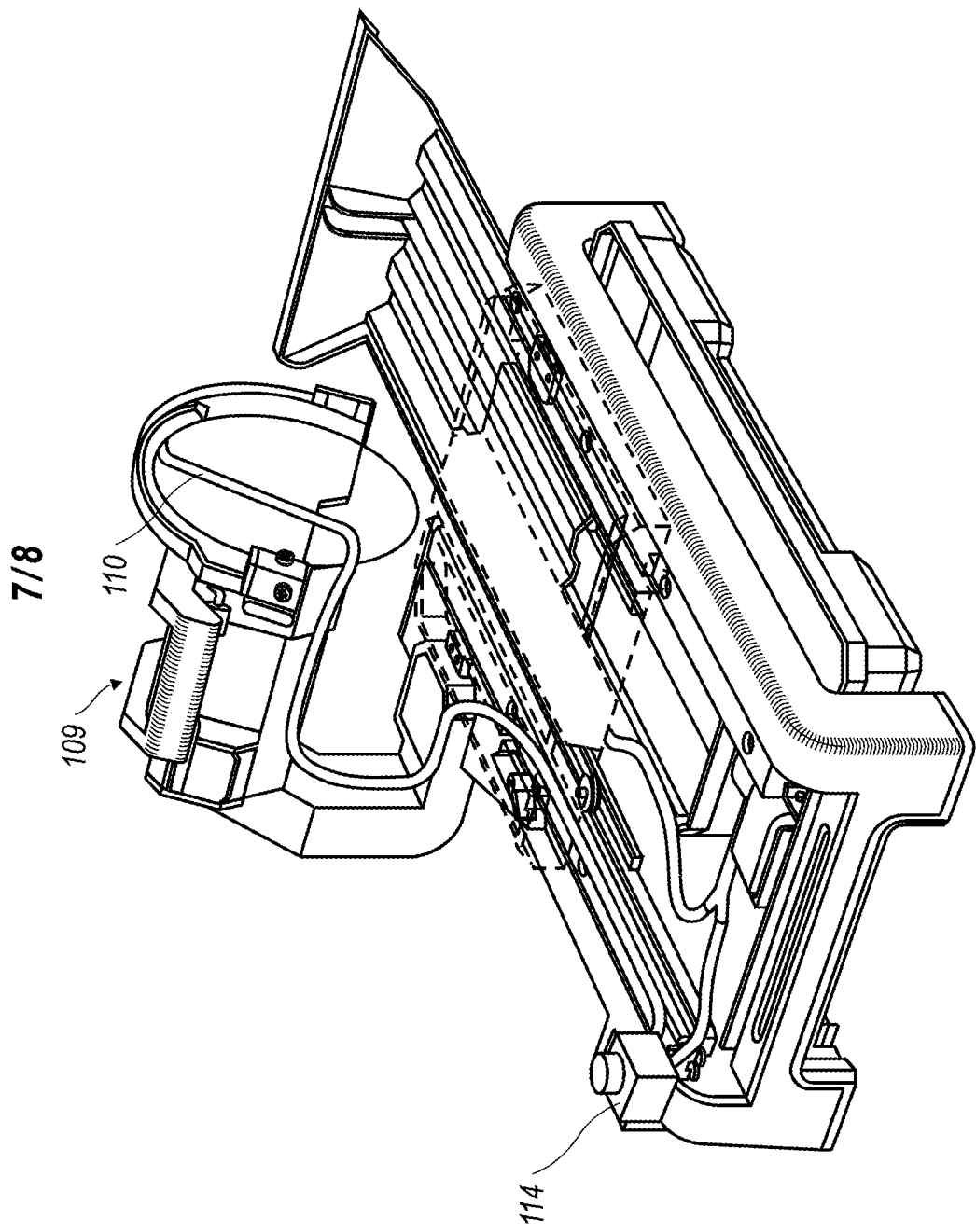


FIG. 8

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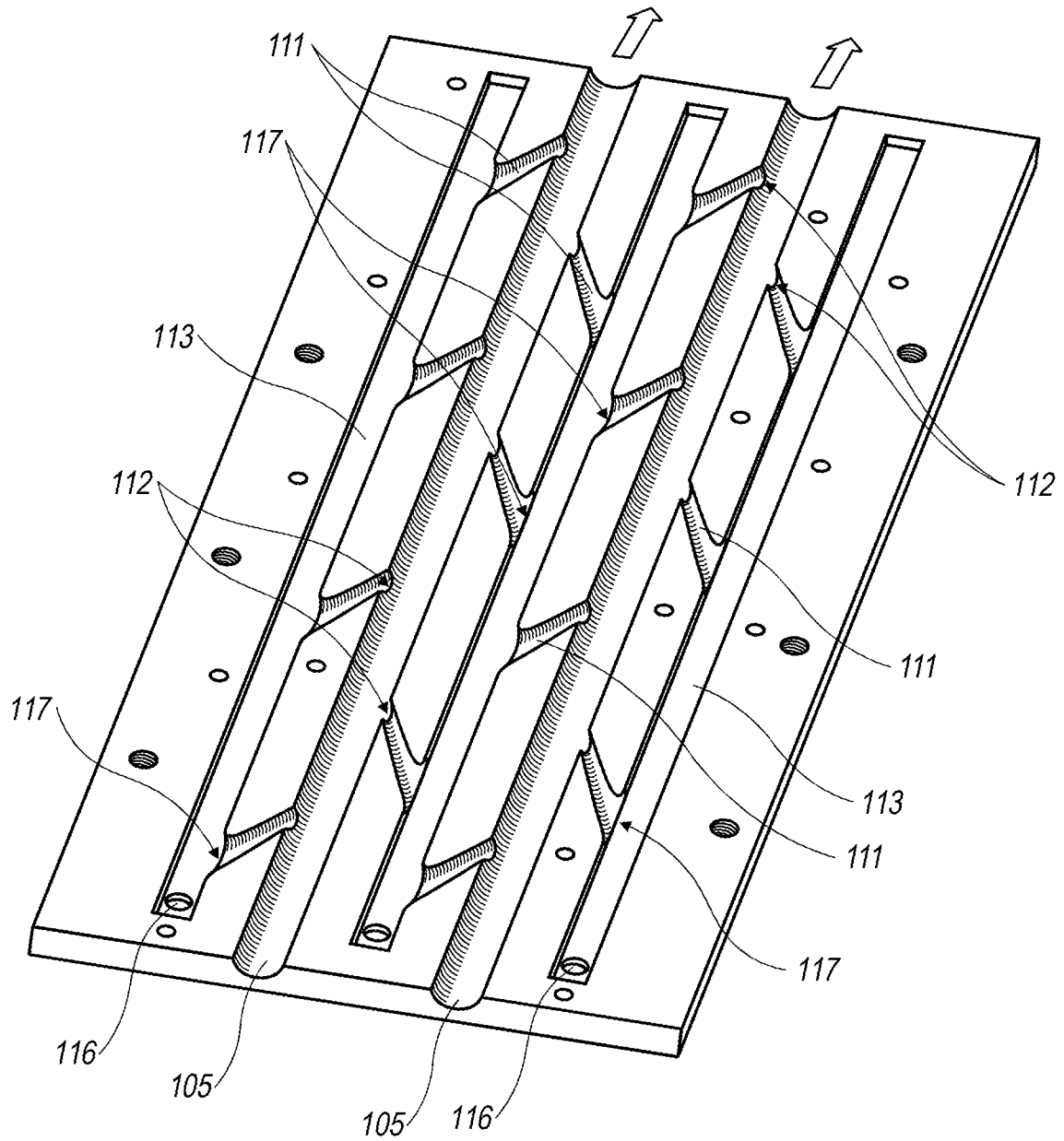


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/037352

A. CLASSIFICATION OF SUBJECT MATTER

INV. B28D7/02 B28D7/04 B28D1/04

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)

B28D B23D

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 practical, 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	JP 2006 312567 A (STEC KK) 16 November 2006 (2006-11-16) the whole document	1-4,7-15
X	US 3 069 950 A (HENSLEY JAMES L) 25 December 1962 (1962-12-25) the whole document in particular: column 3, line 41 - line 48 column 7, line 19 - column 10, line 56 figures 7-10	1-4,7-15
X	US 3 170 352 A (HENSLEY JAMES L) 23 February 1965 (1965-02-23) the whole document in particular: column 5, line 41 - column 8, line 42 figures 7-10	1-4,7-15
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Date of the actual completion of the international search

27 November 2009

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/037352

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