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(54) **Luminaire with LED cartridges**

Leuchte mit LED-Kartuschen

Luminaire à cartouches de DEL

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to luminaires, and more particularly to luminaires formed with LED cartridges.

BACKGROUND

[0002] In recent years LED luminaires have become popular because they are more energy efficient and last longer than luminaires incorporating traditional light sources such as incandescent or fluorescent lights. One drawback of LED luminaires is that, unless costly electronic controls are provided in the luminaire, it can be difficult to increase or decrease the light output of the luminaire if the desired output changes once the luminaire is installed, unlike traditional luminaires in which the existing light bulb can be replaced with one having a higher or lower wattage. Further, when an LED in an LED luminaire does fail, it is often more difficult to replace than the light bulb in a traditional luminaire. Luminaires of the prior art are disclosed in WO 2011/023037 A1, US 2012/162987 A1, US 2013/088864 A1, US 2009/168416 A1, EP 2 327 930 A1 and CN 101 532 624 A. Features of the invention described herein address these shortcomings.

SUMMARY OF THE INVENTION

[0003] In a first aspect, the present invention provides a luminaire according to claim 1.

[0004] The luminaire includes at least two compartments, each compartment retaining a driver and associated electronics, for powering and controlling the at least one LED located within at least one of the plurality of LED cartridges.

[0005] The at least two compartments may be integrally formed with a wire passageway between each of the compartments.

[0006] The electronic housing may comprise steel or aluminum.

[0007] The electronic housing may comprise a top side facing away from an area to be illuminated and an underside facing the area to be illuminated, and the underside comprises a plate to enclose the compartments and contain the driver and optional associated electronics located therein.

[0008] The plate may be hinged to the electronic housing.

[0009] A gasket may be provided between the plate and the electronic housing.

[0010] Each of the LED cartridges comprises an optic covering the at least one PCB and at least one LED mounted to the at least one PCB.

[0011] The optic comprises at least one lens, each of the at least one lenses corresponding to the number of LEDs provided in the LED cartridge.

[0012] Each of the LED cartridges further comprises a casting, the casting including a recess for receiving the PCB, at least one LED mounted thereon, and the optic.

[0013] The casting may be chevron-shaped.

[0014] The casting may be rectangular, square, trapezoidal, polygonal, rhombus, octagonal, pentagonal or hexagonal shaped.

[0015] A plurality of LEDs may be mounted to the at least one PCB.

[0016] Each of the LEDs may be independently selected from a single-die LED, multi-die LED, DC LED, AC LED, organic LED, white LED, colored LED, and multi-colored LED.

[0017] The optic may comprise acrylic or polycarbonate.

[0018] Each of the LED cartridges may further comprise a gasket positioned between the optic and at least one PCB.

[0019] The optic may be an optical assembly comprising a frame having at least one aperture for receiving the at least one lens.

[0020] The frame and at least one lens may be formed separately or may be integrally formed.

[0021] The plurality of LED cartridges may comprise a plug-in electrical connector.

[0022] Each of the plurality of LED cartridges may be connected to a mounting arm, and the mounting arm may be connected to the electronic housing.

[0023] Each of the electronic housing, LED cartridge castings and mounting arm may be independently formed from a thermally conductive material.

[0024] The luminaire may comprise a passageway between each of the plurality of LED cartridges, the passageway providing for convective cooling between each of the plurality of LED cartridges.

[0025] At least one of the LED cartridges may be electrically connected to a driver, and another of the LED cartridges may be either directly connected to a driver or connected to another of the LED cartridges in a series configuration.

[0026] The casting in the LED cartridge may include a recess for receiving the mounting arm.

[0027] The casting in the at least one LED cartridge may include a plurality of ribs for guiding wires from the at least one LED cartridge to the electronic housing.

[0028] Each of the plurality of LED cartridges may be removable from the luminaire so as to allow for easy replacement of the LED cartridges with other LED cartridges.

[0029] The luminaire may be pole-mounted or side-mounted.

[0030] The electronic housing may be attached to a pole-adapter, and the pole-adapter may be attached to a pole.

[0031] The luminaire may further comprise a cable cover for covering wires coming from the pole, pole-adapter or a wall.

[0032] The luminaire may comprise a trim piece on the end of a distal-most LED cartridge.

[0033] In a second aspect, the present invention provides a luminaire, wherein the luminaire comprises an electronic housing and a plurality of removable light-emitting diode ("LED") cartridges, each of the plurality of LED cartridges comprising four printed circuit boards ("PCBs"), each PCB comprising four LEDs mounted thereon and an optic covering each of the PCBs and LEDs mounted thereon,
wherein each of the LED cartridges further comprises a chevron-shaped casting, the casting including a recess for receiving the PCBs, LEDs mounted thereon, and optics.

[0034] The luminaire may be tilted relative to the space to be illuminated by 0 to 20 degrees tilt.

[0035] The luminaire may be tilted relative to the space to be illuminated by 0 to 5 degrees tilt.

BREIF DESCRITPION OF THE DRAWINGS

[0036] Embodiments of the present invention will now be described by way of example only, and with reference to the accompanying drawings, in which:

Figure 1 shows an exploded view of a luminaire in accordance with an embodiment of the invention;
Figure 2 shows a perspective view luminaire in accordance with an embodiment of the invention;
Figure 3 shows an LED cartridge in accordance with an embodiment of the invention;
Figure 4 shows a perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 5 shows a perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 6 shows a perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 7 shows a perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 8 shows a perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 9 shows an LED cartridge in accordance with an embodiment of the invention;
Figure 10 shows an exploded view of a bottom of an LED cartridge in accordance with an embodiment of the invention;
Figure 11 shows an exploded view of a top of an LED cartridge in accordance with an embodiment of the invention;
Figure 12 shows a number of luminaires in accordance with an embodiment of the invention;
Figure 13 shows a front and rear view of a luminaire in accordance with an embodiment of the invention;
Figure 14 shows a side view of a luminaire in accordance with an embodiment of the invention;
Figure 15 shows a bottom view of a luminaire in accordance with an embodiment of the invention;
Figure 16 shows a top view of a luminaire in accordance with an embodiment of the invention;
Figure 17 shows a front and rear view of a luminaire in accordance with an embodiment of the invention;
Figure 18 shows a side view of a luminaire in accordance with an embodiment of the invention;
Figure 19 shows a bottom view of a luminaire in accordance with an embodiment of the invention;
Figure 20 shows a top view of a luminaire in accordance with an embodiment of the invention;
Figure 21 shows various views of a luminaire and a module assembly in accordance with an embodiment of the invention;
Figure 22 shows various views of a luminaire and a module assembly in accordance with an embodiment of the invention;
Figure 23 shows a top perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 24 shows a bottom perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 25 shows a side view of a luminaire in accordance with an embodiment of the invention;
Figure 26 shows a top view of a luminaire in accordance with an embodiment of the invention;
Figure 27 shows a bottom view of a luminaire in accordance with an embodiment of the invention;
Figure 28 shows a front view of a luminaire in accordance with an embodiment of the invention;
Figure 29 shows a back view of a luminaire in accordance with an embodiment of the invention;
Figure 30 shows a top perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 31 shows a bottom perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 32 shows a side view of a luminaire in accordance with an embodiment of the invention;
Figure 33 shows a top view of a luminaire in accordance with an embodiment of the invention;
Figure 34 shows a bottom view of a luminaire in accordance with an embodiment of the invention;
Figure 35 shows a top perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 36 shows a bottom perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 37 shows a side view of a luminaire in accordance with an embodiment of the invention;
Figure 38 shows a top view of a luminaire in accordance with an embodiment of the invention;
Figure 39 shows a bottom view of a luminaire in accordance with an embodiment of the invention;
Figure 40 shows a top perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 41 shows a bottom perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 42 shows a side view of a luminaire in accord-

ance with an embodiment of the invention;
Figure 43 shows a top view of a luminaire in accordance with an embodiment of the invention;
Figure 44 shows a bottom view of a luminaire in accordance with an embodiment of the invention;
Figure 45 shows a top perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 46 shows a bottom perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 47 shows a side view of a luminaire in accordance with an embodiment of the invention;
Figure 48 shows a top view of a luminaire in accordance with an embodiment of the invention;
Figure 49 shows a bottom view of a luminaire in accordance with an embodiment of the invention;
Figure 50 shows a top perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 51 shows a bottom perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 52 shows a side view of a luminaire in accordance with an embodiment of the invention;
Figure 53 shows a top view of a luminaire in accordance with an embodiment of the invention;
Figure 54 shows a bottom view of a luminaire in accordance with an embodiment of the invention;
Figure 55 shows a top perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 56 shows a bottom perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 57 shows a side view of a luminaire in accordance with an embodiment of the invention;
Figure 58 shows a top view of a luminaire in accordance with an embodiment of the invention;
Figure 59 shows a bottom view of a luminaire in accordance with an embodiment of the invention;
Figure 60 shows a top perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 61 shows a bottom perspective view of a luminaire in accordance with an embodiment of the invention;
Figure 62 shows a side view of a luminaire in accordance with an embodiment of the invention;
Figure 63 shows a top view of a luminaire in accordance with an embodiment of the invention; and
Figure 64 shows a bottom view of a luminaire in accordance with an embodiment of the invention.

DETAILED DESCRIPTION

[0037] The subject matter of features of the present invention is described here with specificity to meet statutory requirements, but this description is not necessarily intended to limit the scope of the claims. The claimed subject matter may be embodied in other ways, may include different elements or steps, and may be used in conjunction with other existing or future technologies. This description should not be interpreted as implying any particular order or arrangement among or between various steps or elements except when the order of individual steps or arrangement of elements is explicitly described.

[0038] Certain features of the invention include a luminaire having an electronic housing and at least one LED cartridge mounted onto the electronic housing. The electronic housing includes at least one compartment for housing the driver and/or other electronics for powering and controlling the luminaire. In one illustrated, non-limiting embodiment, two compartments are provided in the electronic housing, each adapted to house a driver. However, any number of compartments may be provided, depending upon the needs of the luminaire.

[0039] In the illustrated embodiment, the two compartments are integrally formed with a wire passageway provided between them. However, other configurations of the electronic housing are certainly contemplated. The electronic housing may be formed from any material having suitable rigidity and thermal properties, including by not limited to metallic materials, such as steel, aluminum, etc.

[0040] A plate is positioned on the underside of the electronic housing to enclose the compartments and contain the electronics housed therein. The plate may be hinged to the housing on one side (see Figure 8) so that the plate remains attached to the housing during servicing of the electronics. However, such hinged attachment is certainly no required. A gasket may optionally be provided at the interface between the electronic housing and the plate to ensure that the compartments are airtight to prevent dust and debris from entering a compartment and detrimentally impacting the electronics therein.

[0041] Any number of LED cartridges may be mounted on the housing, as discussed in more detail below. Each LED cartridge includes a metal (such as aluminum) casting, a printed circuit board ("PCB") populated with light emitting diodes ("LEDs"), and an optic having lenses for positioning over the PCB so that the lenses direct the light emitted by the LEDs. See Figures 3 and 9-11. In some embodiments, the casting includes a recess in its underside to receive the PCB and optic. The PCB and optic may be retained on the casting in any of a variety of ways, including with screws that extend through the optic and PCB and engage the casting. Provision of a recess forms a casting skirt around the LED cartridge to prevent light pollution at 90° from nadir and above. While the casting is shown as chevron-shaped, it could assume other geometric shapes, including, but not limited to, rectangular, square, trapezoidal, polygonal, rhombus, octagonal, pentagonal, hexagonal, etc.

[0042] The PCB may any type of board, including, among others, a metal core board, FR4 board, CHM1 board, etc. Any type and number of LEDs may be arranged on the PCB in any configuration. The LEDs can be single-die or multi-die light emitting diodes, DC or AC,

or can be organic light emitting diodes. LEDs need not be only white LEDs. Rather color or multicolor LEDs may be provided. Nor must all of the LEDs on a PCB be the same color.

[0043] The optic may be a monolithic piece of acrylic, polycarbonate or other suitable material with the lenses formed integrally therein. A gasket (not shown) may be positioned between the optic and the PCB to protect the LEDs from dust and other contaminants. In the illustrated embodiment, the optic is an optical assembly that includes a frame having apertures that receive the lenses. While the frame and lenses could be formed separately and then assembled together, in some embodiments the frame and lenses are integrally formed in a molding process. In one such embodiment, the lenses are formed and positioned in a mold. The frame is then molded around the lenses so that the frame material (e.g., acrylic, polycarbonate, etc.) fuses with the lens material so as to form an integral optic. To the extent one is used, a gasket can be co-molded with the optic so that the resulting optical assembly includes a frame, lenses, and gasket all integrally-formed.

[0044] An optic may be provided with lenses of any type (e.g., Type I-V), and indeed not all of the lenses within an optic need be the same. Moreover, the type, number, and arrangement of LEDs on the PCBs, as well as the lens types provided on the optics, may be different between the different LED cartridges provided in a luminaire.

[0045] Any number of LED cartridges may be mounted on and electrically connected to the electronic housing. See, e.g., Figures 12 and 22. In one embodiment (see Figure 21), each LED cartridge has plug-in electrical connectors so that the necessary electrical connections are made when the cartridge is snapped into an adjacent cartridge (or directly into the electronic housing, if the first in the LED cartridge series).

[0046] In an alternative embodiment (see Figures 1-20), the LED cartridges are indirectly connected to each other and to the electronic housing using a mounting arm. The mounting arm is mounted to the electronic housing and any number of LED cartridges can then be mounted to the mounting arm. Obviously the length of the mounting arm provided in a luminaire will depend on the number of LED cartridges used in the luminaire. The mounting arm may be formed of any material having suitable rigidity and strength to support the LED cartridges, including, but not limited to, metallic materials such as steel, aluminum, etc. Fabrication of the electronic housing, LED cartridge castings, and mounting arm from a thermally conductive material facilitates removal of heat from the assembly. Moreover, the LED cartridges are not directly connected to each other or to the electronic housing. Rather, passageways for convective cooling are provided between adjacent LED cartridges, as shown in Figure 4. Thermal isolation of the electronic housing from the LED cartridges reduces heat transfer to the electronic housing, thereby increasing the luminaire life by keeping the drivers cooler. Moreover, the mounting arm provides a grounding path for each of the LED cartridges.

[0047] The electrical connections are made using a plug and play assembly whereby wires from the electronic housing are connected with the first LED cartridge in a series and, thereafter, the electrical connections are made between adjacent LED cartridges in that series. For example, Figure 2 illustrates an embodiment of a luminaire provided with eight LED cartridges. The first set of four LED cartridges is powered by a first driver, and the second set of four LED cartridges is powered by a second driver. Electrical connections from the electronic housing to the first LED cartridge in the first set are made. Electrical connections are subsequently made with adjacent LED cartridges to thereby connect in series all of the LED cartridges in the first set. With respect to the second set of LED cartridges, wires from the electronic housing bypass the first set of LED cartridges so that the first LED cartridge in the second set is directly connected with the electronic housing (or more specifically, the second driver housed therein). The remaining LED cartridges in the second set are subsequently connected in series to each other.

[0048] The electrical connections are made on the top of the LED cartridge castings so as to be covered by the mounting arm. A recess may be formed in the top of each casting to accommodate the mounting arm. Ribs may be provided in the underside of the mounting arm so as to form a channel or wireway in which the wires may be safety positioned to prevent damage (such as caused by wire pinching). Moreover, ribs may also extend upwardly from a casting to assist with proper positioning of the mounting arm on the casting and help delineate the wireway.

[0049] The use of self-contained LED cartridges facilitates manufacture of a customized luminaire tailored for a particular application. A luminaire emitting the desired light distribution may be configured by controlling the number of LED cartridges used in the luminaire as well as the lumen package and optic selected for each cartridge. Assembly of the luminaire is facilitated by the easy plug and play electrical connections between LED cartridges, which also enable modification of the luminaire (removal, addition, or replacement of LED cartridges) in the field.

[0050] The luminaire may be pole-mounted (see Figures 1, 4-8, 12, and 17-20) or side-mounted (see Figures 12-16). In one embodiment, the electronic housing couples with a pole adapter which brings the cables up from the pole and into the electronic housing. A cable cover (see Figure 1) may be provided to cover the cable coming from the pole adapter (or wall if wall- or side-mounted). Moreover, a trim piece may be provided on the end of the distal-most LED cartridge to impart a polished appearance to the luminaire.

[0051] In one or more embodiments, the luminaire may be tilted relative to the space to be illuminated by 0 to 20 degrees tilt. In particular, the luminaire may be tilted rel-

ative to the space to be illuminated by 0 to 5 degrees tilt.

[0052] Figures 23 to 64 show various views of a luminaire in accordance with an embodiment of the present invention. In particular, these views show a luminaire having different numbers of LED cartridges attached.

[0053] The foregoing is provided for purposes of illustrating, explaining, and describing embodiments of the present invention. Further modifications and adaptations to these embodiments will be apparent to those skilled in the art and may be made without departing from the scope of the invention. Different arrangements of the components depicted in the drawings or described above, as well as components and steps not shown or described are possible. Similarly, some features and subcombinations are useful and may be employed without reference to other features and subcombinations. Embodiments of the invention have been described for illustrative and not restrictive purposes, and alternative embodiments will become apparent to readers of this patent. Accordingly, the present invention is not limited to the embodiments described above or depicted in the drawings, and various embodiments and modifications can be made without departing from the scope of the invention.

[0054] There follows a list of numbered features defining particular embodiments of the invention. Where a numbered feature refers to an earlier numbered feature then those features may be considered in combination.

1. A luminaire comprising: an electronic housing and a plurality of light-emitting diode ("LED") cartridges, each of the plurality of LED cartridges comprising at least one printed circuit board ("PCB") and at least one LED mounted to the at least one PCB.
2. The luminaire according to clause 1, wherein the electronic housing comprises at least one compartment for retaining a driver and, optionally, associated electronics, for powering and controlling the at least one LED located within at least one of the plurality of LED cartridges.
3. The luminaire according to any of the previous clauses, wherein the luminaire includes at least two compartments, each compartment retaining a driver and, optionally, associated electronics, for powering and controlling the at least one LED located within at least one of the plurality of LED cartridges.
4. The luminaire according to clause 3, wherein the at least two compartments are integrally formed with a wire passageway between each of the compartments.
5. The luminaire according to any of the previous clauses, wherein the electronic housing comprises steel or aluminum.
6. The luminaire according to any of the previous clauses, wherein the electronic housing comprises a top side facing away from an area to be illuminated and an underside facing the area to be illuminated, and the underside comprises a plate to enclose the compartments and contain the driver and optional associated electronics located therein.
7. The luminaire according to clause 6, wherein the plate is hinged to the electronic housing.
8. The luminaire according to any one of clauses 6 or 7, wherein a gasket is provided between the plate and the electronic housing.
9. The luminaire according to any of the previous clauses, wherein each of the LED cartridges further comprise an optic covering the at least one PCB and at least one LED mounted to the at least one PCB.
10. The luminaire according to clause 9, wherein the optic comprises at least one lens, each of the at least one lenses corresponding to the lumber of LEDs provided in the LED cartridge.
11. The luminaire according to clauses 9 or 10, wherein each of the LED cartridges further comprises a casting, the casting including a recess for receiving the PCB, at least one LED mounted thereon, and the optic.
12. The luminaire according to clause 11, wherein the casting is chevron-shaped.
13. The luminaire according to clause 11, wherein the casting is rectangular, square, trapezoidal, polygonal, rhombus, octagonal, pentagonal or hexagonal shaped.
14. The luminaire according to any of the previous clauses, wherein a plurality of LEDs are mounted to the at least one PCB.
15. The luminaire according to any of the previous clauses, wherein each of the LEDs is independently selected from a single-die LED, multi-die LED, DC LED, AC LED, organic LED, white LED, colored LED, and multi-colored LED.
16. The luminaire according to any of the previous clauses, wherein the optic comprises acrylic or polycarbonate.
17. The luminaire according to any of the previous clauses, wherein each of the LED cartridges further comprises a gasket positioned between the optic and at least one PCB.
18. The luminaire according to any of the previous clauses, wherein the optic is an optical assembly comprising a frame having at least one aperture for receiving the at least one lens.
19. The luminaire according to clause 18, wherein the frame and at least one lens are formed separately or are integrally formed.
20. The luminaire according to any of the previous clauses, wherein each of the plurality of LED cartridges comprise a plug-in electrical connector.
21. The luminaire according to any of the previous clauses, wherein each of the plurality of LED cartridges are connected to a mounting arm, and the mounting arm is connected to the electronic housing.
22. The luminaire according to any of the previous clauses, wherein each of the electronic housing, LED cartridge castings and mounting arm are independ-

ently formed from a thermally conductive material.

23. The luminaire according to any of the previous clauses, wherein the luminaire comprises a passageway between each of the plurality of LED cartridges, the passageway providing for convective cooling between each of the plurality of LED cartridges.

24. The luminaire according to any of the previous clauses, wherein at least one of the LED cartridges is electrically connected to a driver, and another of the LED cartridges is either directly connected to a driver or connected to another of the LED cartridges in a series configuration.

25. The luminaire according to any of the previous clauses, wherein the casting in the LED cartridge includes a recess for receiving the mounting arm.

26. The luminaire according to any of the previous clauses, wherein the casting in the at least one LED cartridge includes a plurality of ribs for guiding wires from the at least one LED cartridge to the electronic housing.

27. The luminaire according to any of the previous clauses, wherein each of the plurality of LED cartridges is removable from the luminaire so as to allow for easy replacement of the LED cartridges with other LED cartridges.

28. The luminaire according to any of the previous clauses, wherein the luminaire is pole-mounted or side-mounted.

29. The luminaire according to any of the previous clauses, wherein the electronic housing is attached to a pole-adapter, and the pole-adapter is attached to a pole.

30. The luminaire according to clauses 28 or 29, wherein the luminaire further comprises a cable cover for covering wires coming from the pole, pole-adapter or a wall.

31. The luminaire according to any of the previous clauses, wherein the luminaire comprises a trim piece on the end of a distal-most LED cartridge.

32. A luminaire, comprising an electronic housing and a plurality of removable light-emitting diode ("LED") cartridges, each of the plurality of LED cartridges comprising four printed circuit boards ("PCBs"), each PCB comprising four LEDs mounted thereon and an optic covering each of the PCBs and LEDs mounted thereon,
wherein each of the LED cartridges further comprises a chevron-shaped casting, the casting including a recess for receiving the PCBs, LEDs mounted thereon, and optics.

33. A luminaire according to any of the previous clauses, wherein the luminaire may be tilted relative to the space to be illuminated by 0 to 20 degrees tilt.

34. A luminaire according to any of the previous clauses, wherein the luminaire may be tilted relative to the space to be illuminated by 0 to 5 degrees tilt.

Claims

1. A luminaire comprising: an electronic housing, a mounting arm and a plurality of light-emitting diode ("LED") cartridges, each of the plurality of LED cartridges comprising:

a casting;
at least one printed circuit board ("PCB") populated with at least one LED and mounted on the casting; and
an optic, having at least one lens, positioned over the PCB so that the at least one lens directs light emitted from the at least one LED,

wherein each of the plurality of cartridges are mounted on the mounting arm which is connected to the electronic housing and the cartridges are separable from the mounting arm and **characterized in that** the electronic housing includes at least two compartments, each compartment retaining a driver and associated electronics, for powering and controlling the at least one LED located within at least one of the plurality of LED cartridges, the two compartments being positioned on opposing sides of the mounting arm.

2. The luminaire according to claim 1, wherein the at least two compartments are integrally formed with a wire passageway between each of the compartments.

3. The luminaire according to claim 1 or 2, wherein the electronic housing comprises a top side facing away from an area to be illuminated and an underside facing the area to be illuminated, and the underside comprises a plate to enclose the compartments and contain the driver and optional associated electronics located therein.

4. The luminaire according to any of the previous claims, wherein each of the LED cartridges further comprises a recess in the casting for receiving the PCB and the optic.

5. The luminaire according to any of the previous claims, wherein each of the plurality of LED cartridges is snap-fit onto another of the plurality of LED cartridges or onto the electronic housing, each LED cartridge having plug-in electrical connectors.

6. The luminaire according to any of the previous claims, wherein each of the electronic housing, LED cartridge castings and mounting arm are independently formed from a thermally conductive material.

7. The luminaire according to any of the previous claims, wherein passageways exist between adja-

cent LED cartridges, the passageways providing for convective cooling between the adjacent LED cartridges.

8. The luminaire according to any of the previous claims, wherein at least one of the LED cartridges is electrically connected to a driver, and another of the LED cartridges is either directly connected to a driver or connected to another of the LED cartridges in a series configuration.

9. The luminaire according to any of the previous claims, wherein each of the plurality of LED cartridges is removable from the luminaire so as to allow for replacement of an LED cartridges with another LED cartridge.

10. A luminaire according to any of the previous claims, wherein the luminaire may be tilted relative to the space to be illuminated by 0 to 20 degrees tilt.

11. A luminaire according to any of the previous claims, wherein the casting of each of the plurality of LED cartridges is chevron-shaped.

12. A luminaire according to any of the previous claims, wherein the plurality of LED cartridges are connected in series.

13. A luminaire according to any of the previous claims, wherein at least one of the following is different between at least two of the plurality of LED cartridges: the type of LEDs, the number of LEDs, the arrangement of LEDs, or the optic.

Patentansprüche

1. Leuchte, die aufweist: eine Elektronikumhüllung, einen Montagearm und eine Mehrzahl von Licht-emittierenden-Dioden ("LED")-Einsätzen, wobei jeder der Mehrzahl von LED-Einsätzen aufweist:

ein Gussstück,
zumindest eine Leiterplatte ("PCB"), die zumindest mit einer LED bestückt ist und auf dem Gussstück montiert ist, und
eine Optik, die zumindest eine Linse hat, die über der PCB positioniert ist, so dass die zumindest eine Linse Licht, das von dem zumindest einen LED emittiert wird, leitet,

wobei jeder der Mehrzahl von Einsätzen auf dem Montagearm, der mit der Elektronikumhüllung verbunden ist, montiert ist und die Einsätze von dem Montagearm separierbar sind, und **dadurch gekennzeichnet ist, dass**
die Elektronikumhüllung zumindest zwei Abteilungen enthält, wobei jede der Abteilungen einen Antrieb und assoziierte Elektronik hält, um die zumindest eine LED, die innerhalb zumindest einer der Mehrzahl von LED-Einsätzen lokalisiert ist, mit Energie zu versorgen und zu steuern, wobei die zwei Abteilungen auf entgegengesetzten Seiten des Montagearms positioniert sind.

2. Leuchte nach Anspruch 1, wobei die zumindest zwei Abteilungen mit einem Kabeldurchgang zwischen jeder der Abteilungen einstückig gebildet sind.

3. Leuchte nach einem der Ansprüche 1 oder 2, wobei die Elektronikumhüllung eine Oberseite, die von einer zu erleuchtenden Fläche weg weist, und eine Unterseite, die zu der zu erleuchtenden Fläche hin weist, aufweist und die Unterseite eine Platte aufweist, um die Abteilungen zu umschließen und den Antrieb und optional assoziierte Elektronik zu beinhalten, die darin lokalisiert ist.

4. Leuchte nach einem der vorigen Ansprüche, wobei jeder der LED-Einsätze außerdem eine Aussparung in dem Gussstück aufweist, um die PCB und die Optik zu erhalten.

5. Leuchte nach einem der vorigen Ansprüche, wobei jeder der LED-Einsätze an einem anderen der Mehrzahl von LED-Einsätzen oder an der Elektronikumhüllung eingerastet wird, wobei jeder LED-Einsatz elektrische Einsteckverbinder hat.

6. Leuchte nach einem der vorigen Ansprüche, wobei jedes der Elemente, Elektronikumhüllungen, LED-Einsatzgussstück und Montagearme, aus einem thermisch leitenden Material unabhängig gebildet ist.

7. Leuchte nach einem der vorigen Ansprüche, wobei Durchgänge zwischen benachbarten LED-Einsätzen vorhanden sind, wobei die Durchgänge konvektive Kühlung zwischen den benachbarten LED-Einsätzen bereitstellen.

8. Leuchte nach einem der vorigen Ansprüche, wobei zumindest einer der LED-Einsätze mit einem Antrieb elektrisch verbunden ist, und ein anderer der LED-Einsätze entweder direkt mit einem Antrieb verbunden ist oder in einer Reihenkonfiguration mit einem anderen LED-Einsatz verbunden ist.

9. Leuchte nach einem der vorigen Ansprüche, wobei jeder der Mehrzahl von LED-Einsätzen von der Leuchte entfernbar ist, um den Ersatz eines LED-Einsatzes mit einem anderen LED-Einsatz zu ermöglichen.

10. Leuchte nach einem der vorigen Ansprüche, wobei

die Leuchte relativ zu dem zu erleuchtenden Raum um 0 bis 20 Grad Neigung geneigt werden kann.

11. Leuchte nach einem der vorigen Ansprüche, wobei das Gussstück von jeder der Mehrzahl von LED-Einsätze V-förmig ist.

12. Leuchte nach einem der vorigen Ansprüche, wobei die Mehrzahl von LED-Einsätzen in Reihe verbunden ist.

13. Leuchte nach einem der vorigen Ansprüche, wobei zumindest eines der folgenden zwischen zumindest zwei der Mehrzahl von LED-Einsätzen verschieden ist: Art der LEDs, Anzahl der LEDs, Arrangement der LEDs oder Optik.

Revendications

1. Luminaire comprenant : un logement électronique, un bras de montage et une pluralité de cartouches à diode électroluminescente (« LED »), chacune parmi la pluralité de cartouches à LED comprenant :

une pièce moulée ;
au moins une carte de circuit imprimé (« PCB ») équipée d'au moins une LED et montée sur la pièce moulée ; et
un optique, possédant au moins une lentille, positionnée par-dessus la PCB pour que l'au moins une lentille dirige de la lumière émise à partir de l'au moins une LED,
dans lequel chacune parmi la pluralité de cartouches est montée sur le bras de montage qui est raccordé au logement électronique et les cartouches sont séparables du bras de montage, et **caractérisé en ce que**
le logement électronique inclut au moins deux compartiments, chaque compartiment retenant un conducteur et des composants électroniques associés, pour alimenter et commander l'au moins une LED située à l'intérieur d'au moins l'une parmi la pluralité de cartouches à LED, les deux compartiments étant positionnés sur des côtés opposés du bras de montage.

2. Luminaire selon la revendication 1, dans lequel les au moins deux compartiments sont formés de façon monobloc avec une voie de passage de fil entre chacun des compartiments.

3. Luminaire selon la revendication 1 ou 2, dans lequel le logement électronique comprend un côté supérieur orienté à l'opposé d'une zone destinée à être éclairée et un côté inférieur faisant face à la zone destinée à être éclairée, et le côté inférieur comprend une plaque pour enfermer les compartiments et contenir le conducteur et les composants électroniques optionnels associés situés dans ceux-ci.

4. Luminaire selon l'une quelconque des revendications précédentes, dans lequel chacune parmi les cartouches à LED comprend en outre un évidement dans la pièce moulée pour recevoir la PCB et l'optique.

5. Luminaire selon l'une quelconque des revendications précédentes, dans lequel chacune parmi la pluralité de cartouches à LED est ajustée par encliquetage sur une autre parmi la pluralité de cartouches à LED ou sur le logement électronique, chaque cartouche à LED possédant des connecteurs électriques enfichables.

6. Luminaire selon l'une quelconque des revendications précédentes, dans lequel chacun parmi le logement électronique, les pièces moulées de cartouches à LED et le bras de montage sont formés indépendamment d'un matériau thermiquement conducteur.

7. Luminaire selon l'une quelconque des revendications précédentes, dans lequel des voies de passage existent entre des cartouches à LED adjacentes, les voies de passage permettant le refroidissement par convection entre les cartouches à LED adjacentes.

8. Luminaire selon l'une quelconque des revendications précédentes, dans lequel au moins une des cartouches à LED est électriquement connectée à un conducteur, et une autre des cartouches à LED est directement connectée à un conducteur ou connectée à une autre des cartouches à LED en une configuration en série.

9. Luminaire selon l'une quelconque des revendications précédentes, dans lequel chacune parmi la pluralité de cartouches à LED peut être enlevée du luminaire afin de permettre le remplacement d'une cartouche à LED avec une autre cartouche à LED.

10. Luminaire selon l'une quelconque des revendications précédentes, dans lequel le luminaire peut être incliné, par rapport à l'espace destiné à être éclairé, d'une inclinaison de 0 à 20 degrés.

11. Luminaire selon l'une quelconque des revendications précédentes, dans lequel la pièce moulée de chacune parmi la pluralité de cartouches à LED présente une forme de chevron.

12. Luminaire selon l'une quelconque des revendications précédentes, dans lequel la pluralité de cartouches à LED sont connectées en série.

13. Luminaire selon l'une quelconque des revendications précédentes, dans lequel au moins l'un de ce qui suit est différent entre au moins deux parmi la pluralité de cartouches à LED : le type des LED, le nombre des LED, l'agencement des LED, ou l'optique.

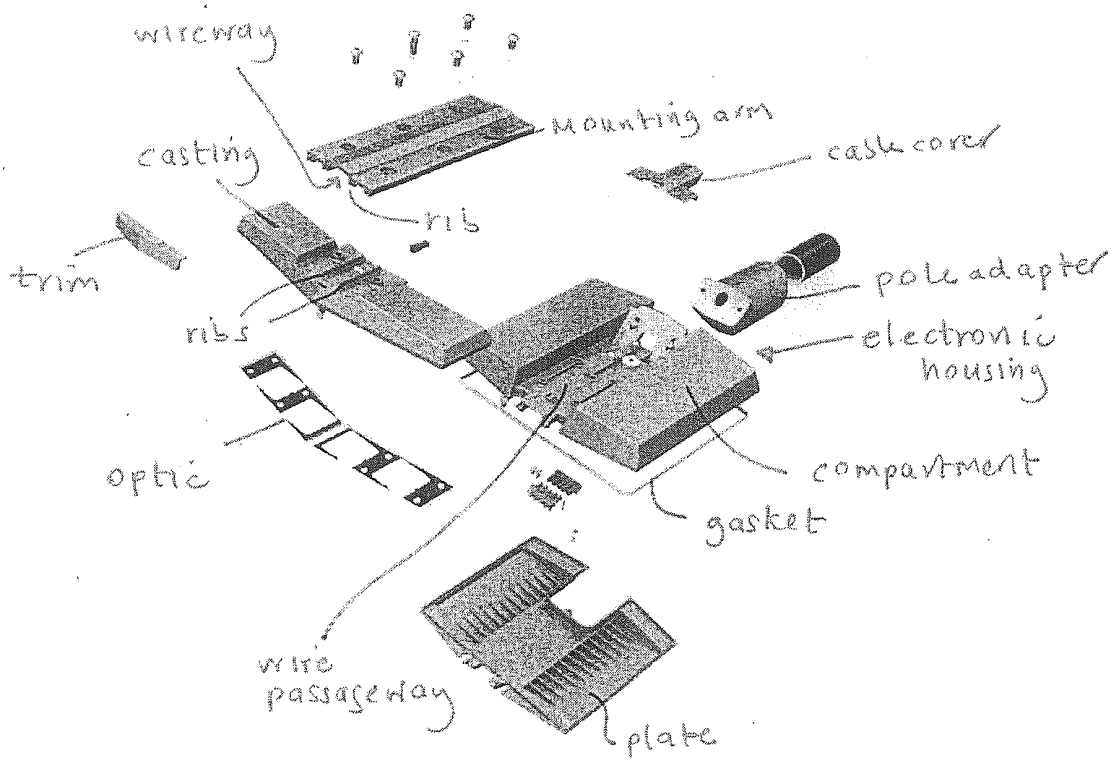


Figure 1

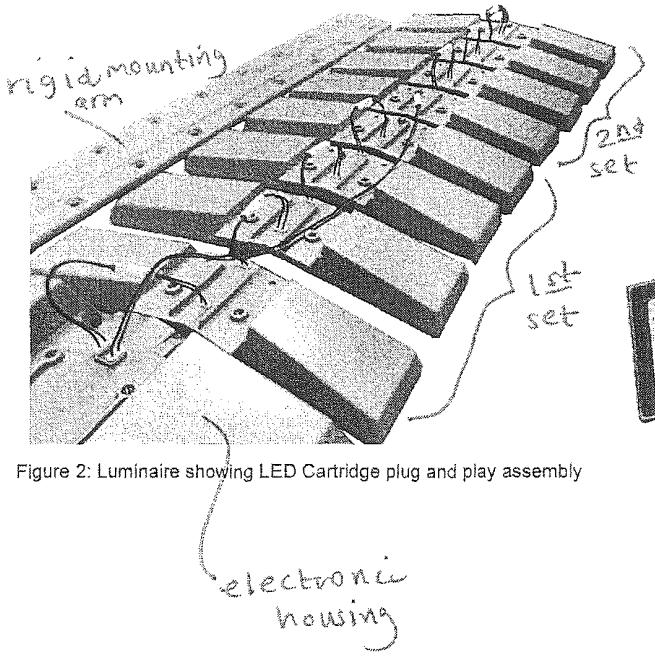


Figure 2: Luminaire showing LED Cartridge plug and play assembly

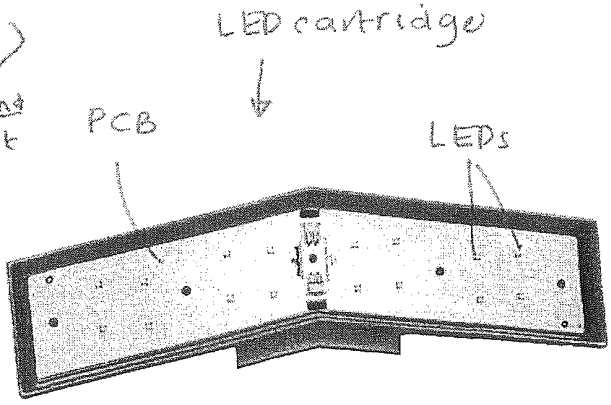


Figure 3: LED Cartridge PCB layout; 16 LEDs connected in series

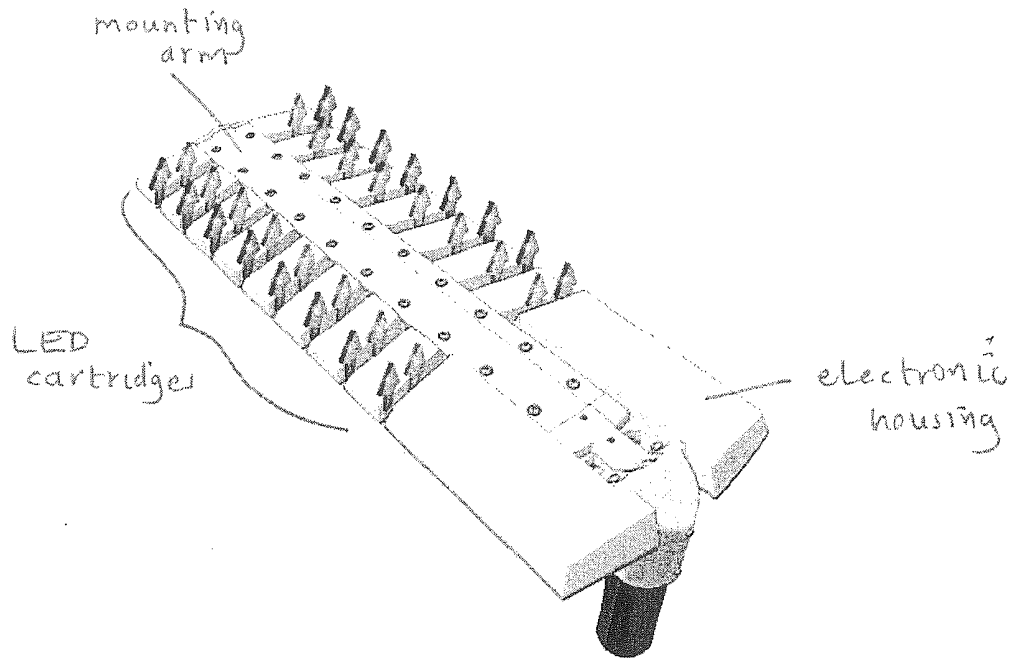


Figure 4: LED Modules are independent and act as heat sink(s) that benefit from convection and conduction thermal management.

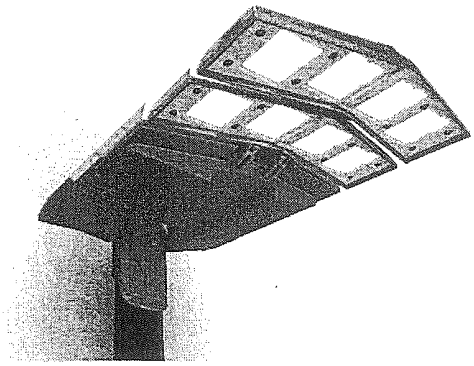


Figure 5: Luminaire with 2 LED Cartridges

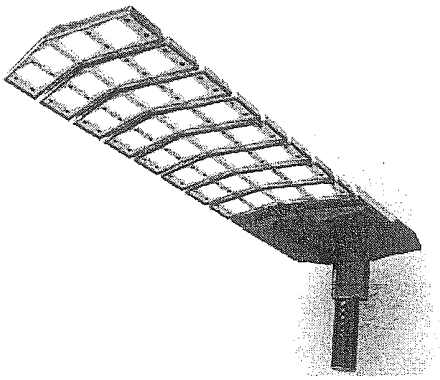
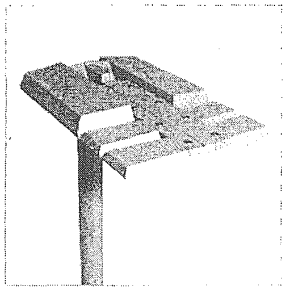
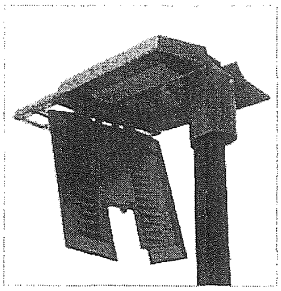


Figure 6: Luminaire with 8 LED Cartridges



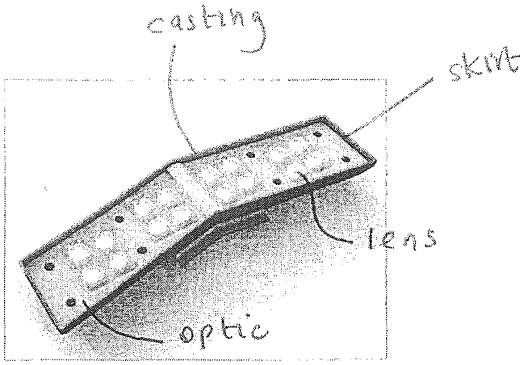
V-MAX™ Post Top

Figure 7



V-MAX™ Gear Capsule

Figure 8



V-MAX™ LED Module

Figure 9

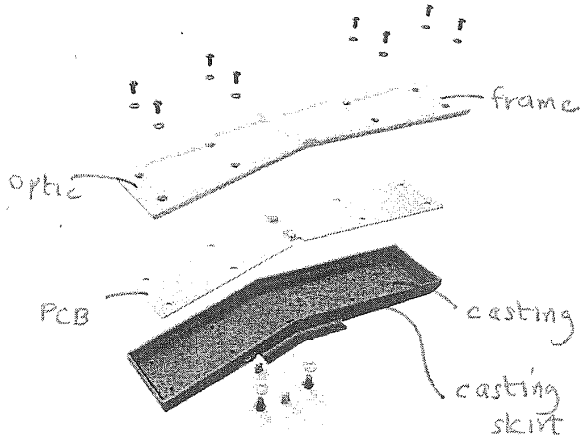


Figure 10: LED Cartridge bottom exploded view

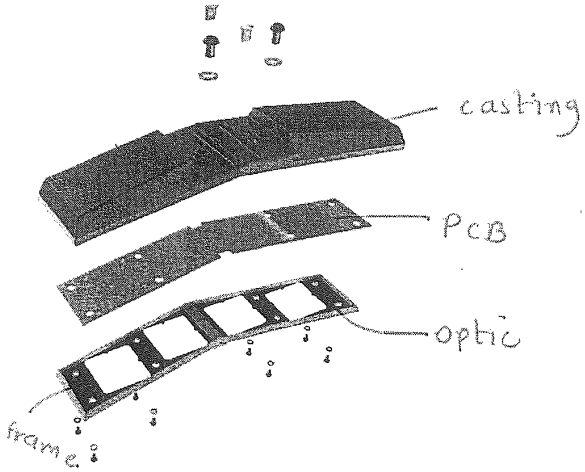
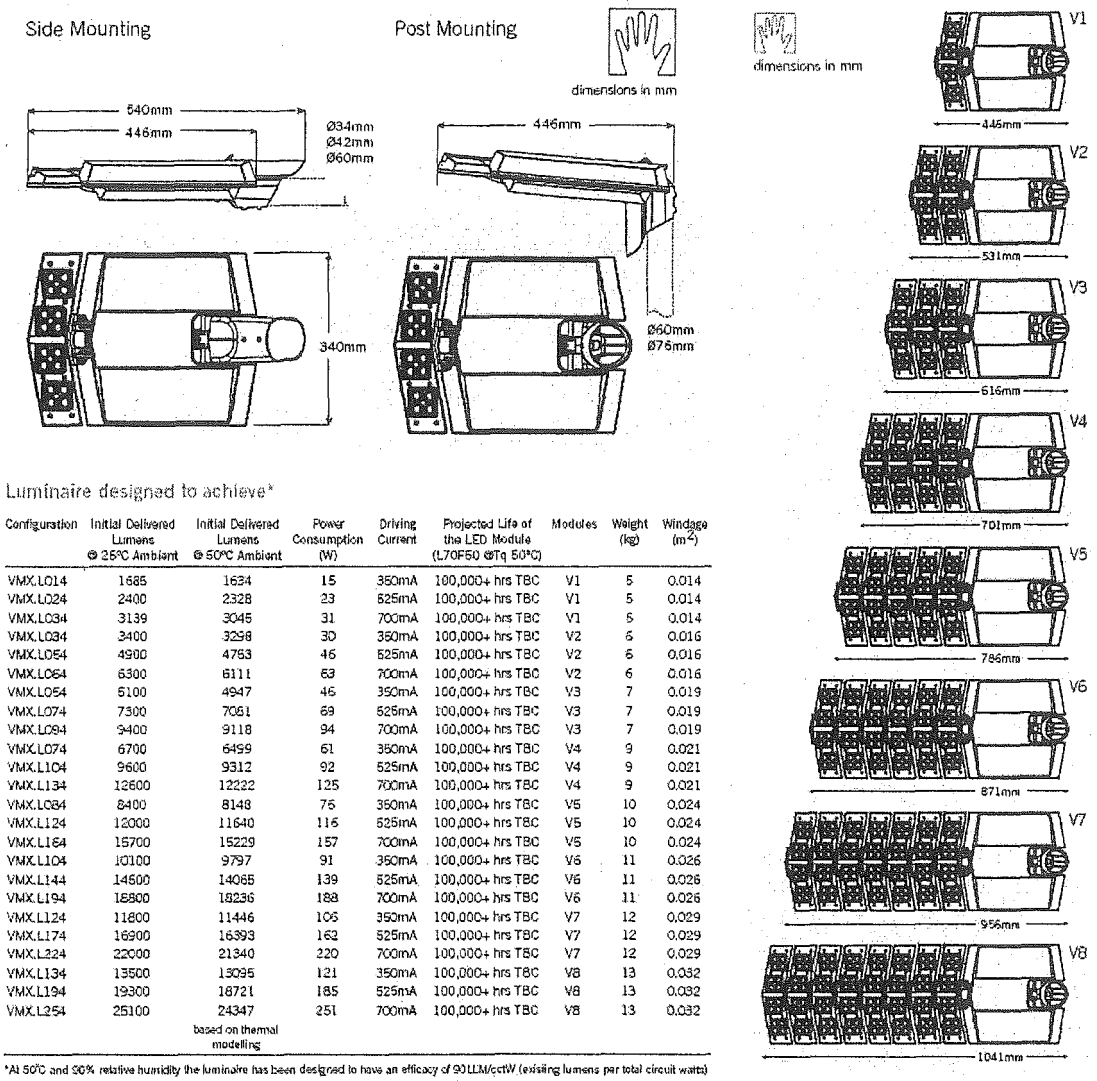


Figure 11: LED Cartridge top exploded view



Luminaire designed to achieve*

Configuration	Initial Delivered Lumens @ 25°C Ambient	Initial Delivered Lumens @ 50°C Ambient	Power Consumption (W)	Driving Current	Projected Life of the LED Module (L70F50 @Tq 50°C)	Modules	Weight (kg)	Windage (m^2)
VMX.L014	1685	1634	15	350mA	100,000+ hrs TBC	V1	5	0.014
VMX.L024	2400	2328	23	525mA	100,000+ hrs TBC	V1	5	0.014
VMX.L034	3139	3045	31	700mA	100,000+ hrs TBC	V1	5	0.014
VMX.L034	3400	3298	30	350mA	100,000+ hrs TBC	V2	6	0.016
VMX.L054	4900	4753	46	525mA	100,000+ hrs TBC	V2	6	0.016
VMX.L064	6300	6111	63	700mA	100,000+ hrs TBC	V2	6	0.016
VMX.L054	5100	4947	46	350mA	100,000+ hrs TBC	V3	7	0.019
VMX.L074	7300	7081	69	525mA	100,000+ hrs TBC	V3	7	0.019
VMX.L094	9400	9118	94	700mA	100,000+ hrs TBC	V3	7	0.019
VMX.L074	6700	6499	61	350mA	100,000+ hrs TBC	V4	9	0.021
VMX.L104	9600	9312	92	525mA	100,000+ hrs TBC	V4	9	0.021
VMX.L134	12600	12222	125	700mA	100,000+ hrs TBC	V4	9	0.021
VMX.L084	8400	8148	76	350mA	100,000+ hrs TBC	V5	10	0.024
VMX.L124	12000	11640	116	525mA	100,000+ hrs TBC	V5	10	0.024
VMX.L164	15700	15229	157	700mA	100,000+ hrs TBC	V5	10	0.024
VMX.L104	10100	9797	91	350mA	100,000+ hrs TBC	V6	11	0.026
VMX.L144	14600	14065	139	525mA	100,000+ hrs TBC	V6	11	0.026
VMX.L194	18800	18236	188	700mA	100,000+ hrs TBC	V6	11	0.026
VMX.L124	11800	11446	106	350mA	100,000+ hrs TBC	V7	12	0.029
VMX.L174	16900	16393	162	525mA	100,000+ hrs TBC	V7	12	0.029
VMX.L224	22000	21340	220	700mA	100,000+ hrs TBC	V7	12	0.029
VMX.L134	13500	13095	121	350mA	100,000+ hrs TBC	V8	13	0.032
VMX.L194	19300	18721	185	525mA	100,000+ hrs TBC	V8	13	0.032
VMX.L254	25100	24347	251	700mA	100,000+ hrs TBC	V8	13	0.032
		based on thermal modelling						

*At 50°C and 90% relative humidity the luminaire has been designed to have an efficacy of 90 LLM/cctW (existing lumens per total circuit watts)

Figure 12: Luminaire design maximizes number of configuration available to the customer

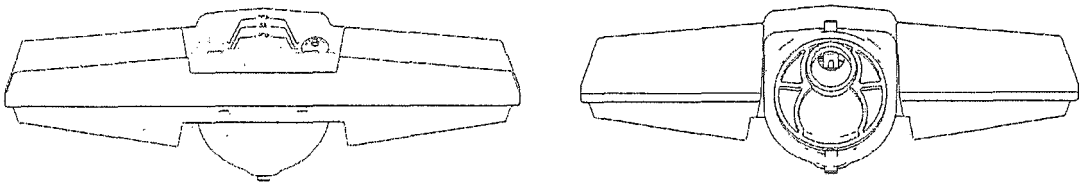


Figure 13: Luminaire Front and Rear view (Side entry)

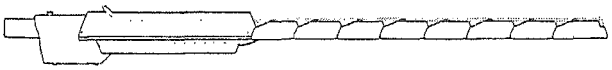


Figure 14: Luminaire Side view (Side entry)

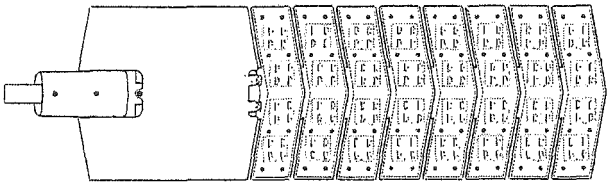


Figure 15: Luminaire Bottom view (Side entry)

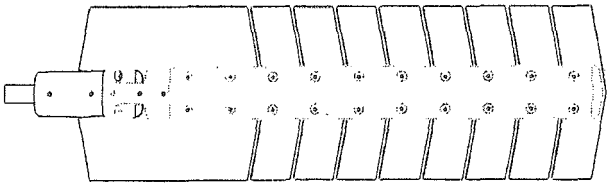


Figure 16: Luminaire Top view (Side entry)

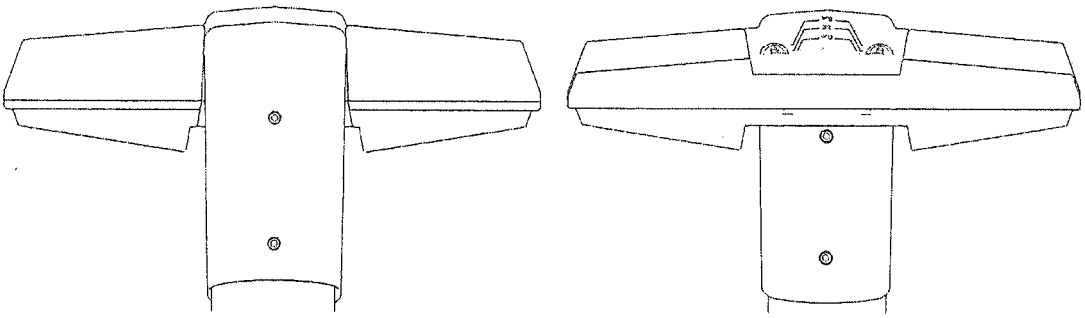


Figure 17: Luminaire Front and Rear view (Post Top)

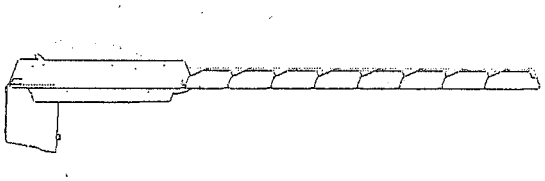


Figure 18: V-Max Luminaire Side view (Post Top)

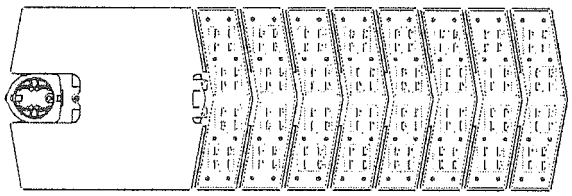


Figure 19: V-Max Luminaire Bottom view (Post Top)

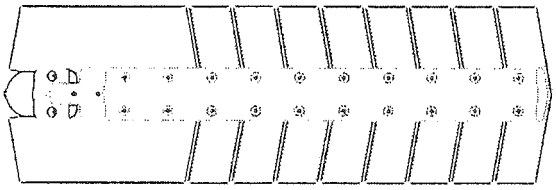


Figure 20: V-Max Luminaire Top view (Post Top)

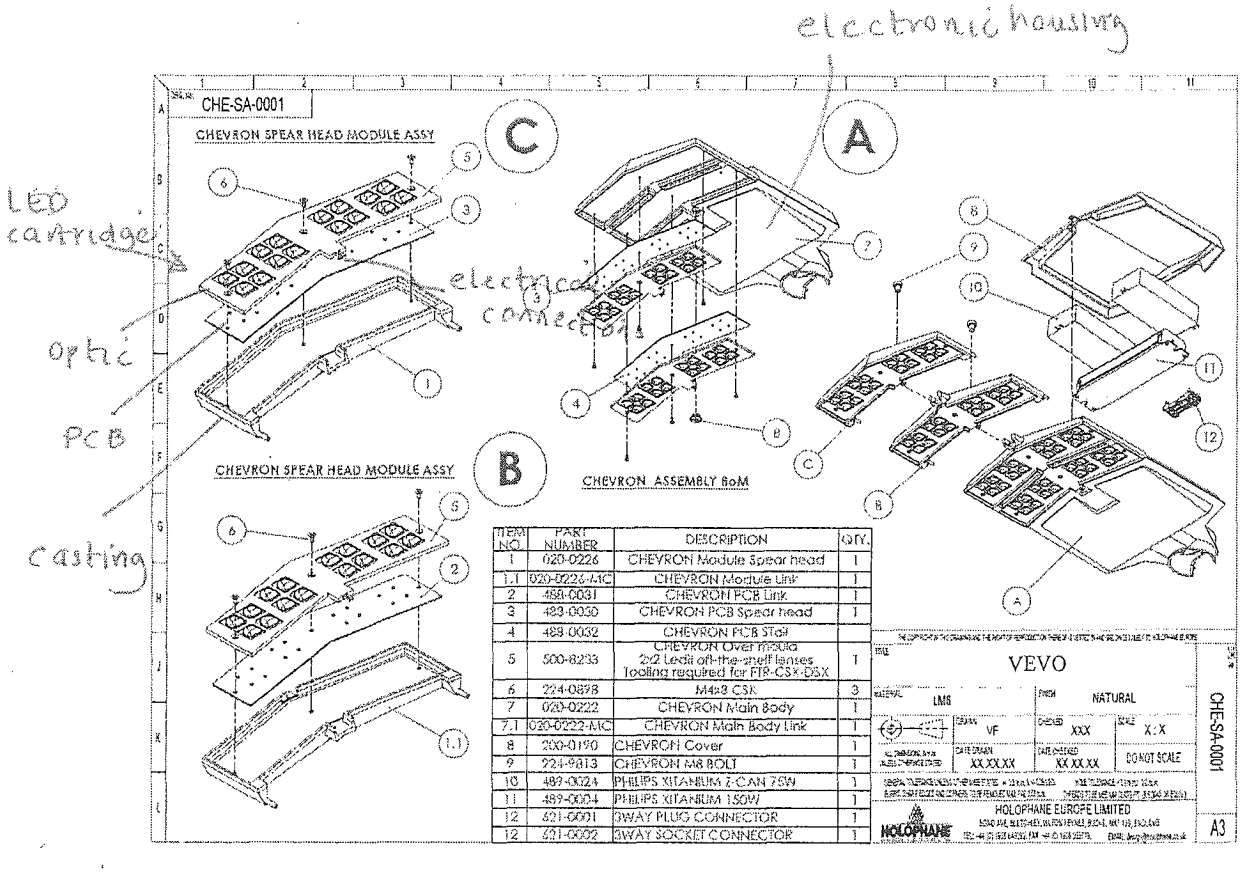

electronic housing
LED cartridge
optic
PCB
casting
electrical connection
CHE-SA-0001
CHEVRON SPEAR HEAD MODULE ASSY
CHEVRON SPEAR HEAD MODULE ASSY
CHEVRON ASSEMBLY BoM
C
A
B
ITEM NO.
PART NUMBER
DESCRIPTION
QTY.
1 020-0226 CHEVRON Module Spear head 1
1.1 020-0226-MC CHEVRON Module Link 1
2 489-0031 CHEVRON PCB Link 1
3 489-0030 CHEVRON PCB Spear head 1
4 489-0032 CHEVRON PCB Star
5 500-8233 CHEVRON Over moulds 2x2 Ledil off-the-shelf lenses Tooling required for FTR-CSX-DSX 1
6 224-0898 M4x8 CSK 3
7 020-0222 CHEVRON Main Body 1
7.1 020-0222-MC CHEVRON Main Body Link 1
8 200-0190 CHEVRON Cover 1
9 224-9813 CHEVRON M8 BOLT 1
10 489-0024 PHILIPS XITANIUM Z-CAN 75W 1
11 489-0004 PHILIPS XITANIUM 150W 1
12 621-0001 3WAY PLUG CONNECTOR 1
12 621-0002 3WAY SOCKET CONNECTOR 1
VEVO
LMS
NATURAL
VF
XXX
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DO NOT SCALE
HOLOPHANE EUROPE LIMITED
CHE-SA-0001
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Figure 21

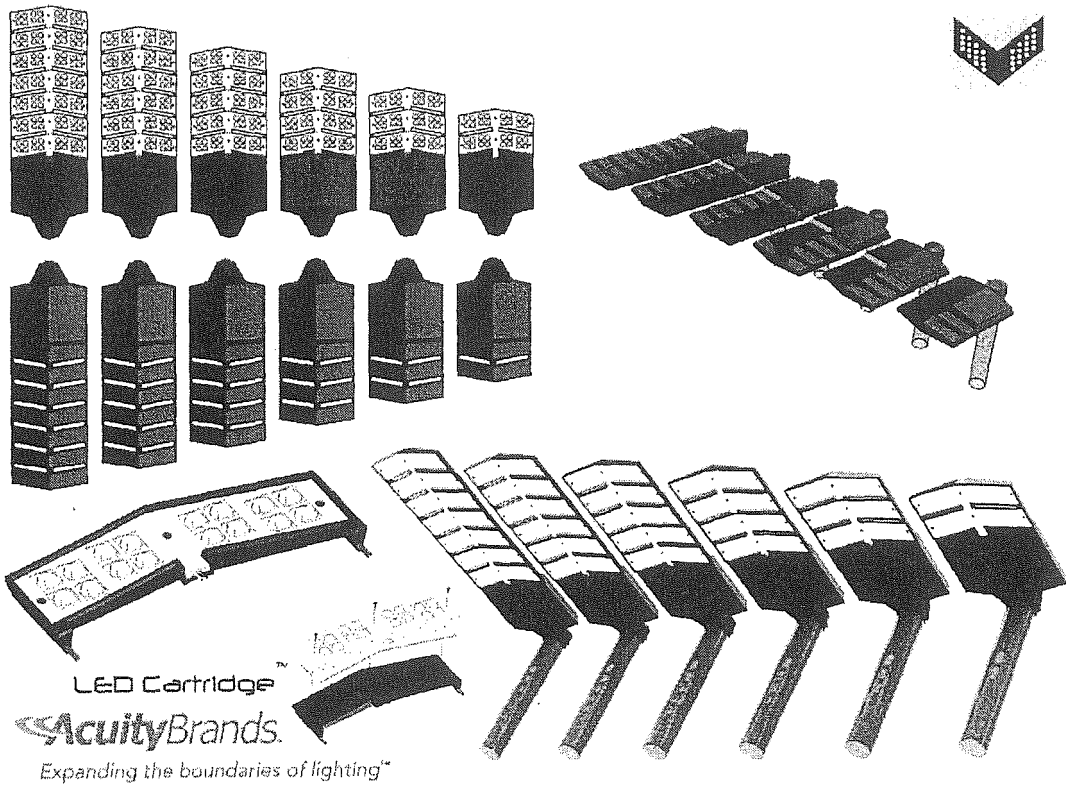

LED Cartridge™
AcuityBrands.
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Figure 22

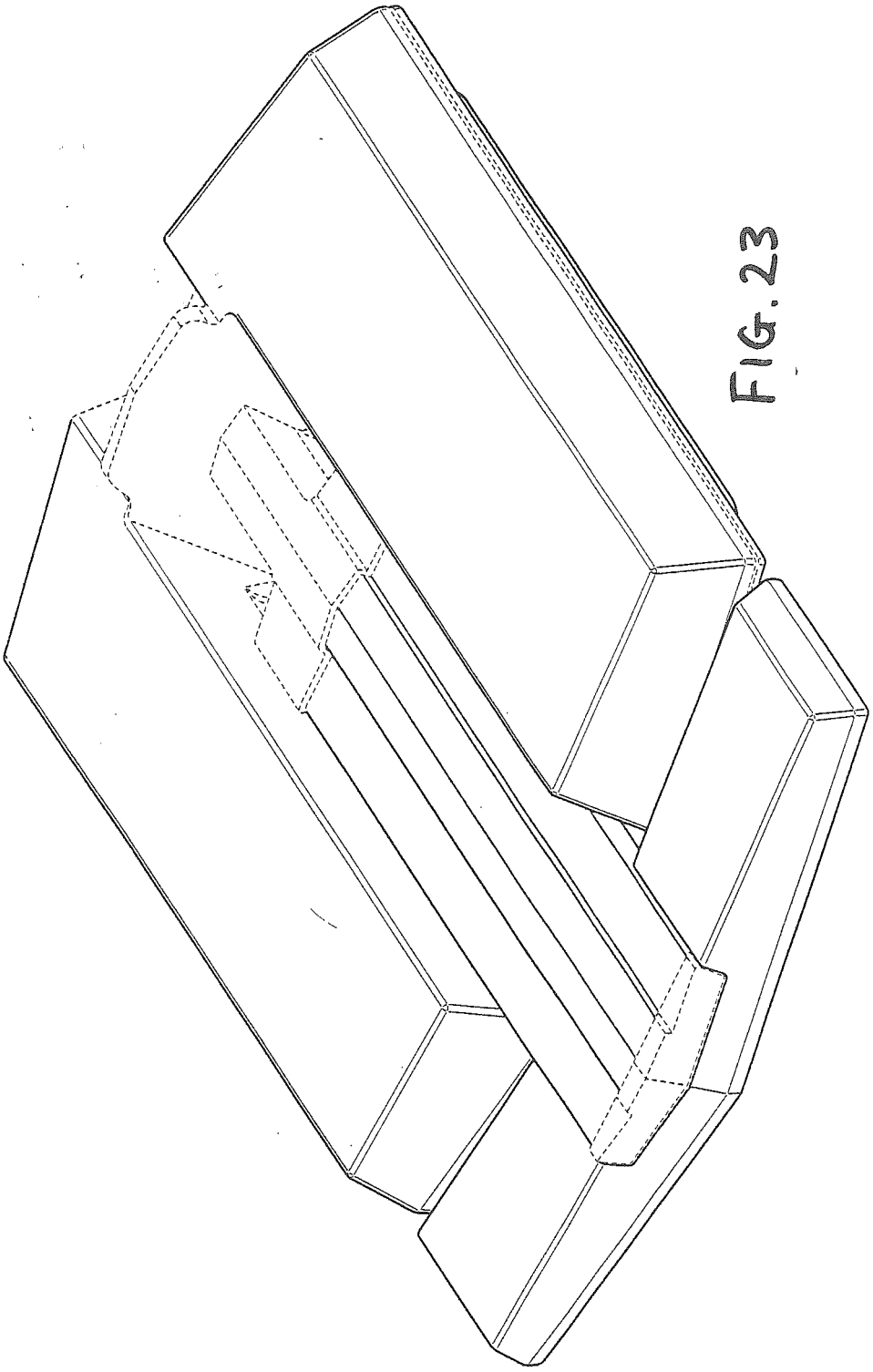


FIG. 23

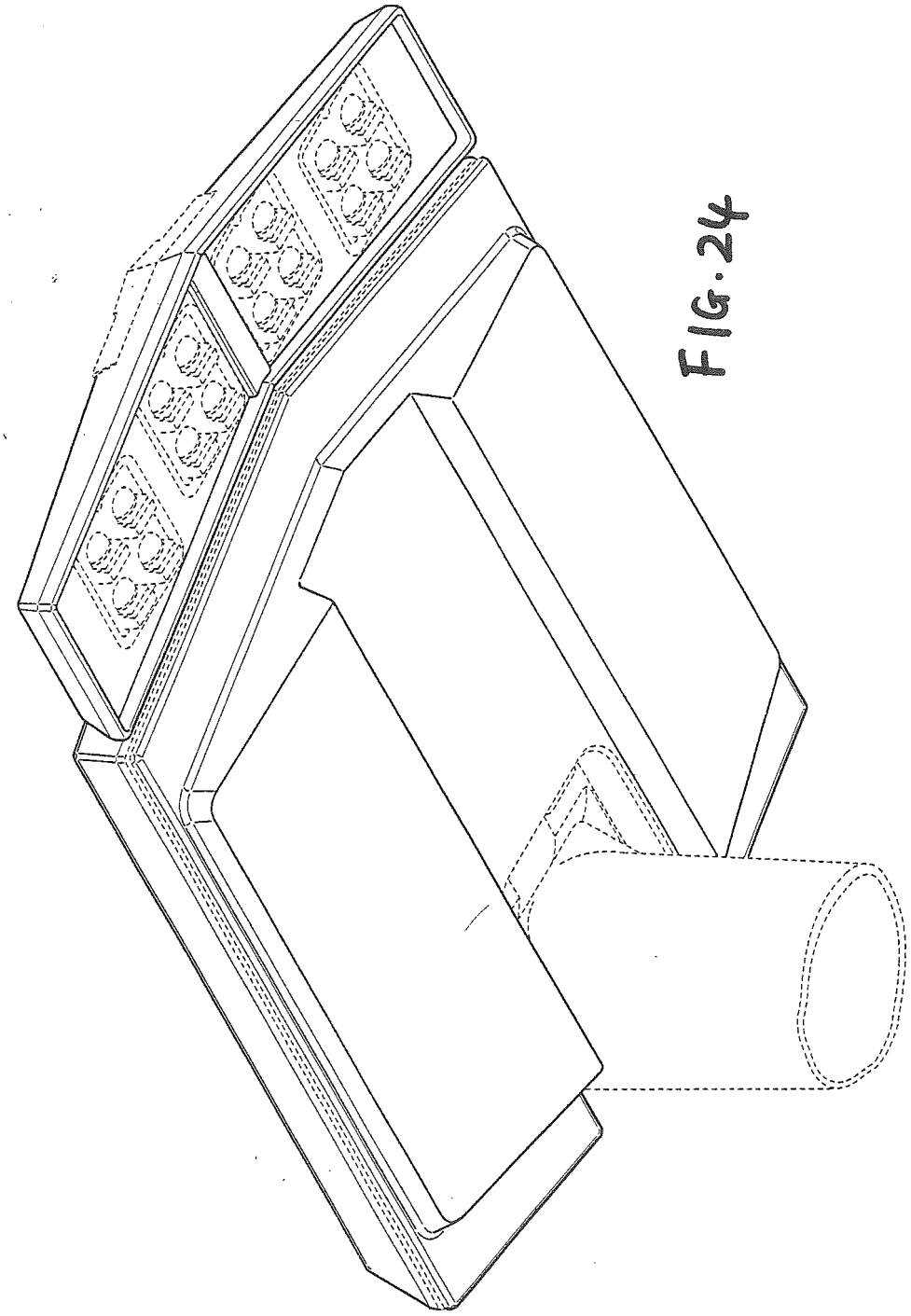


FIG. 24

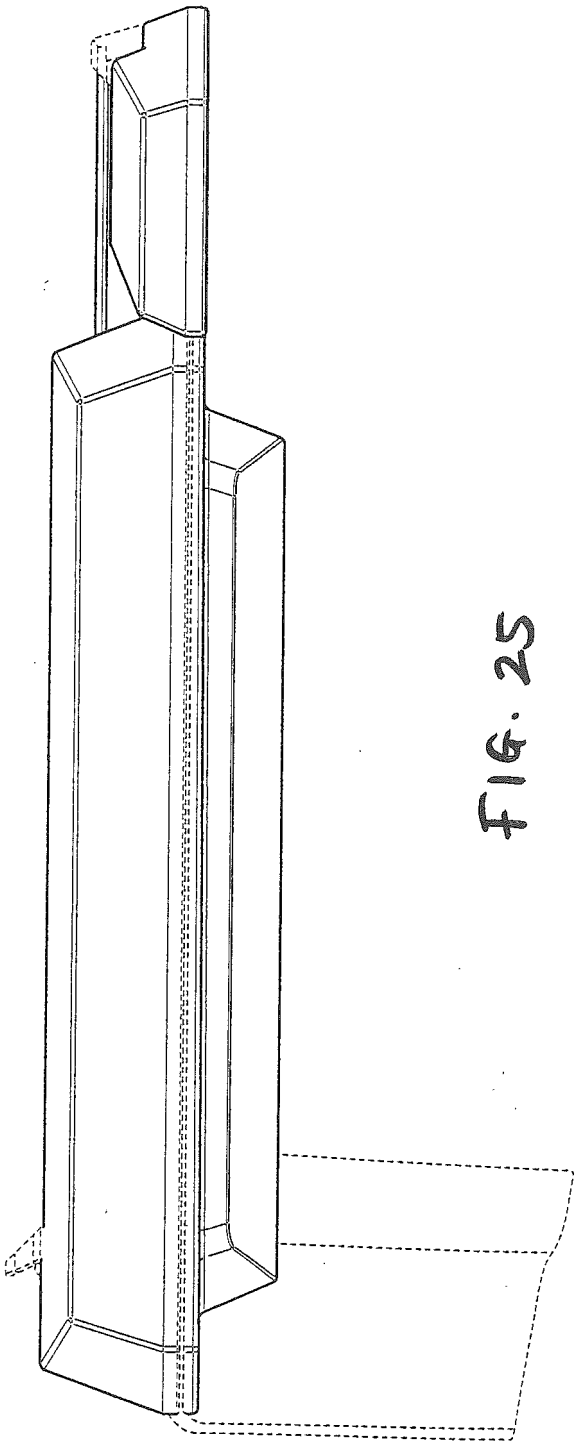


FIG. 25

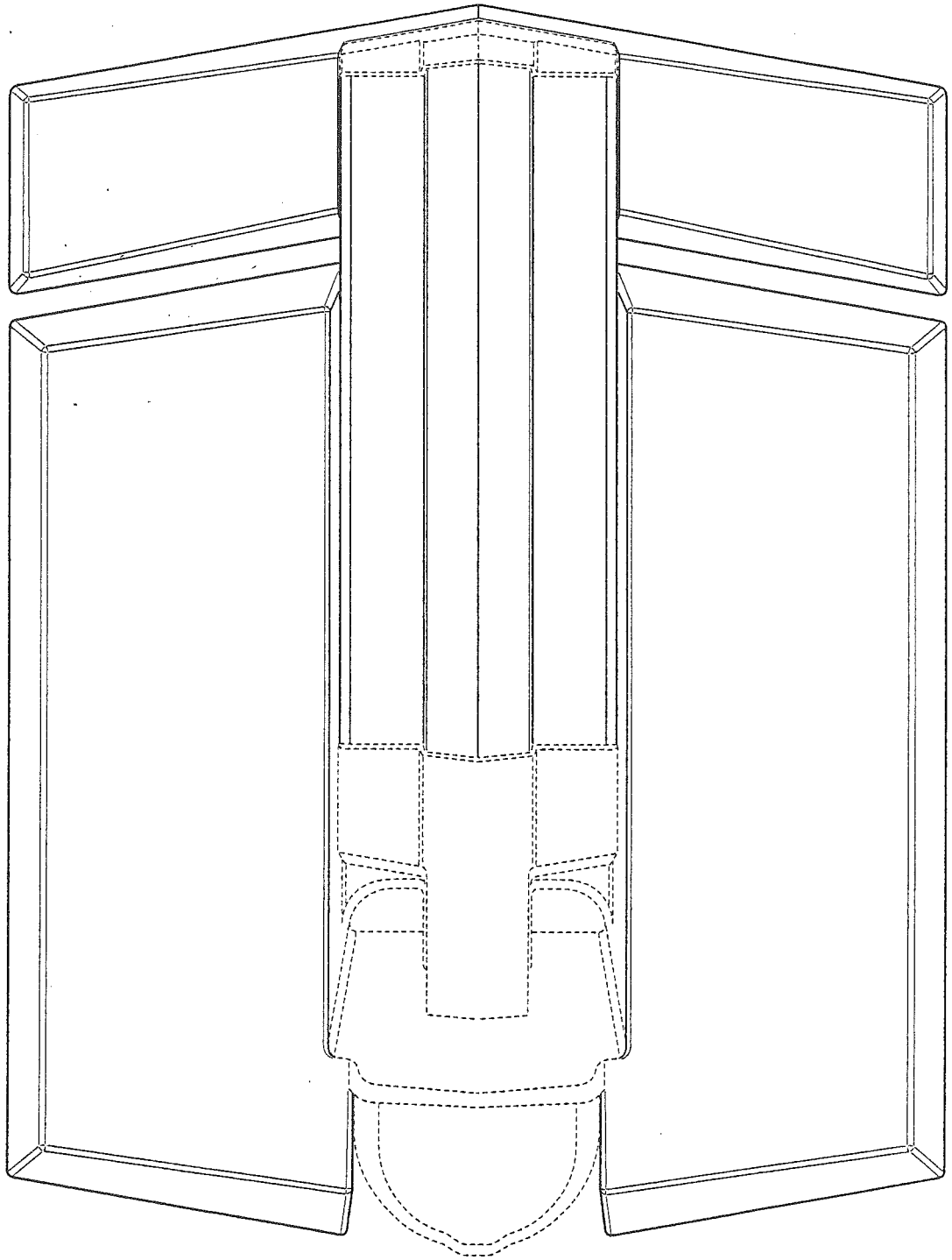


FIG. 26

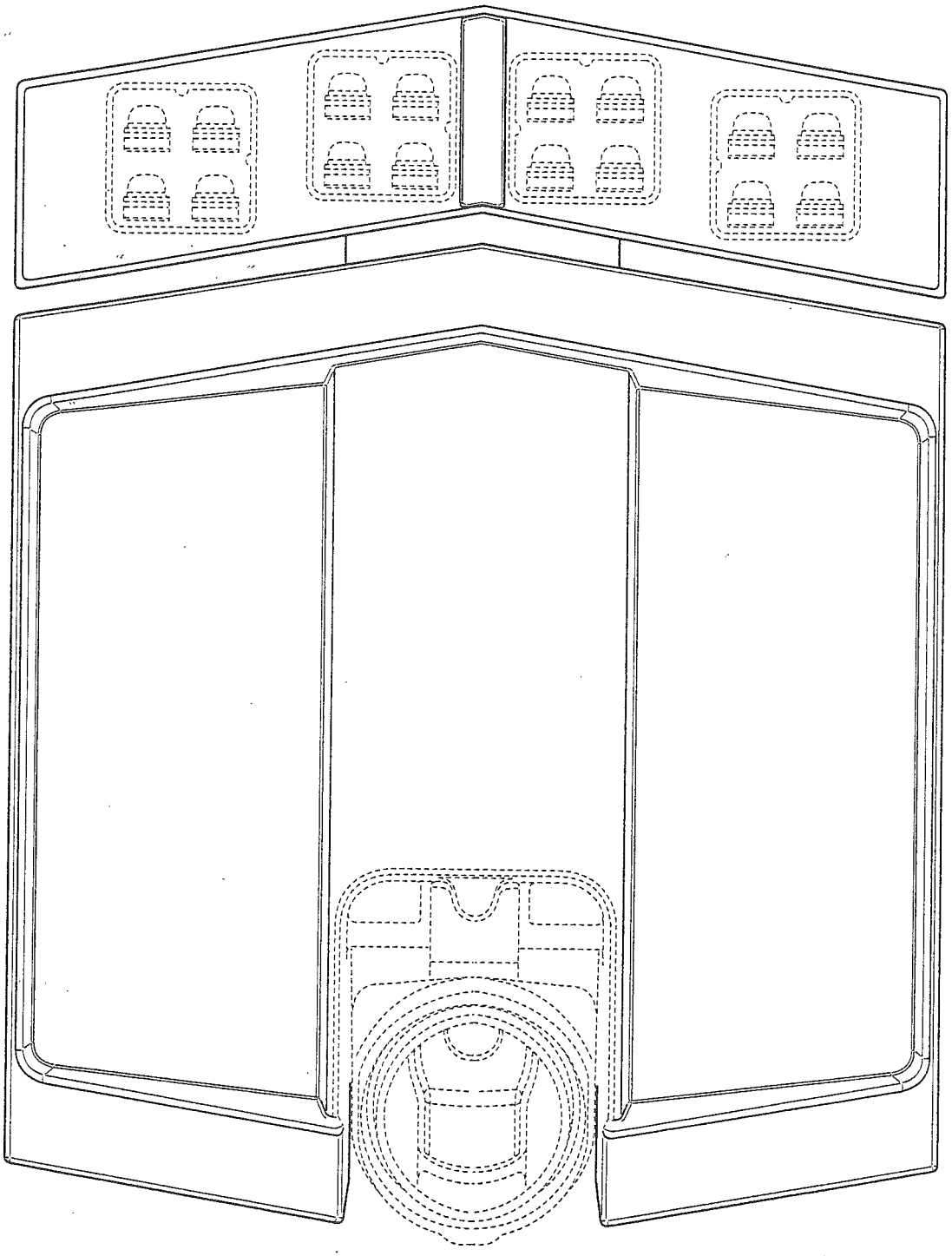


FIG. 27

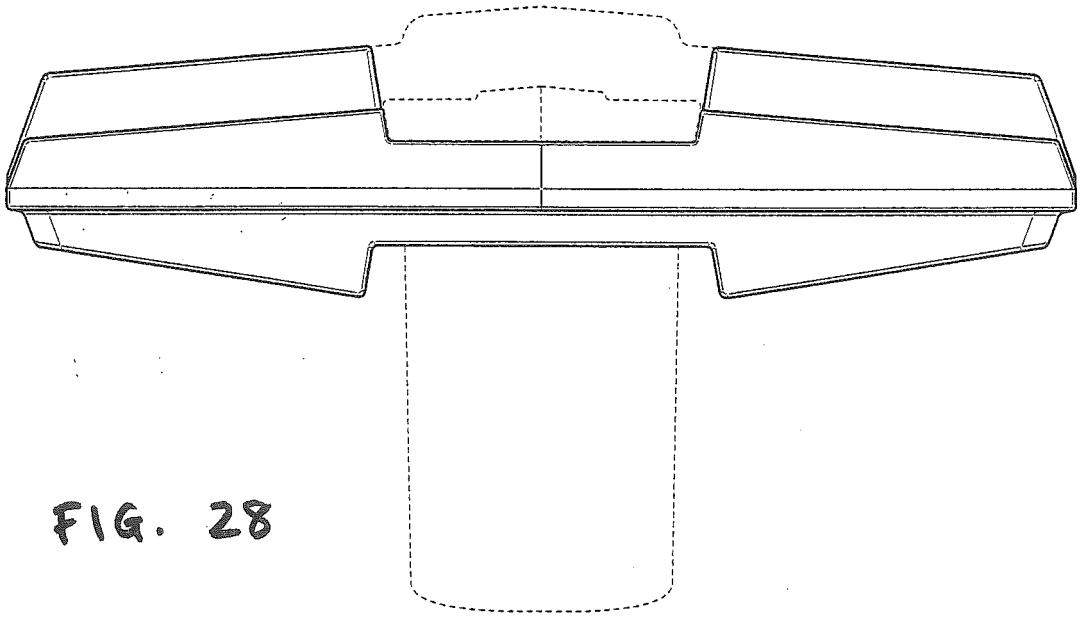


FIG. 28

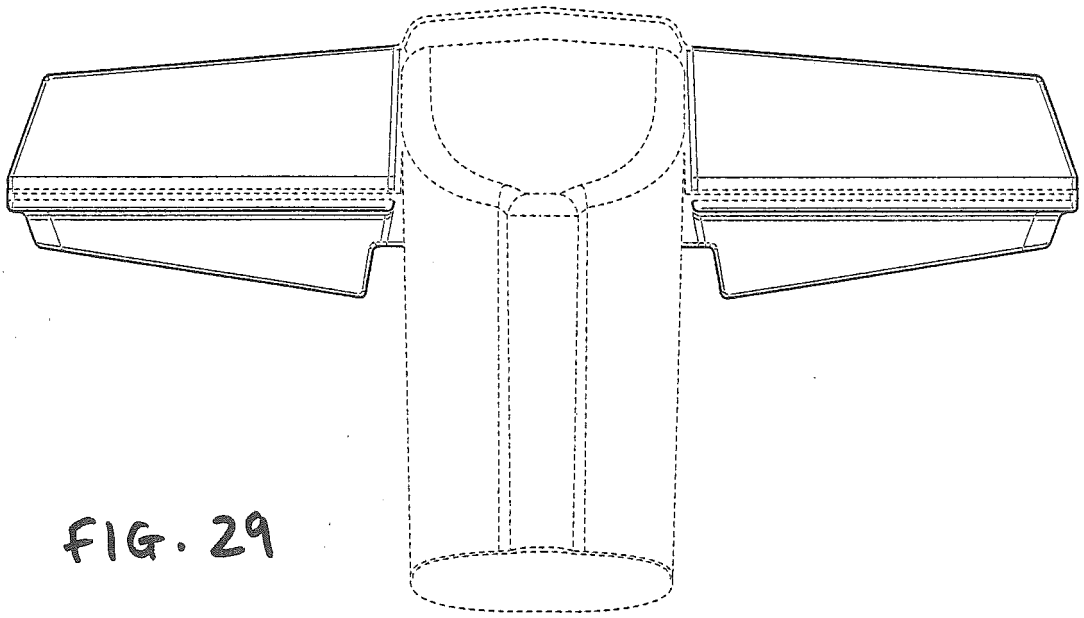


FIG. 29

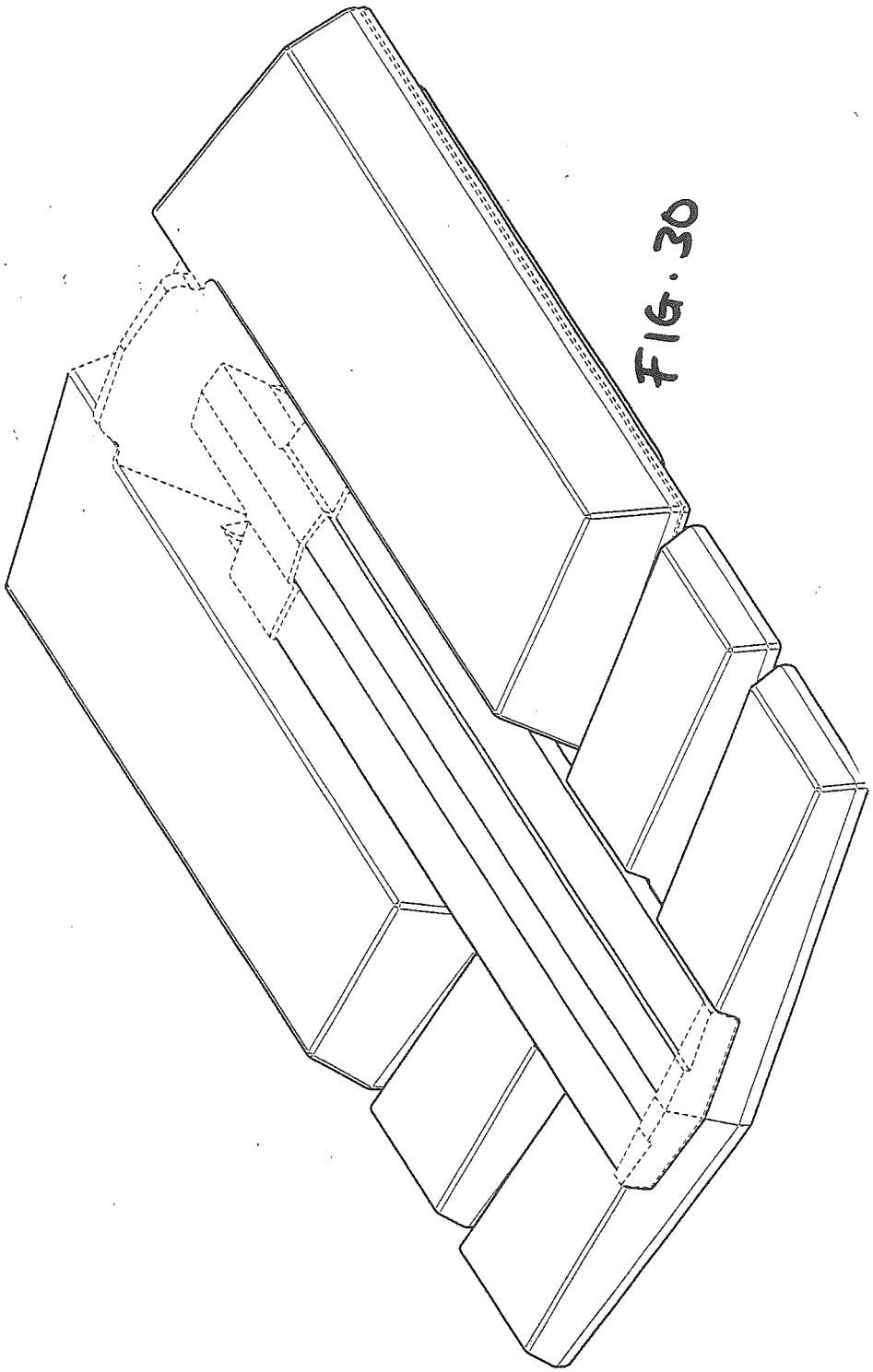


FIG. 30

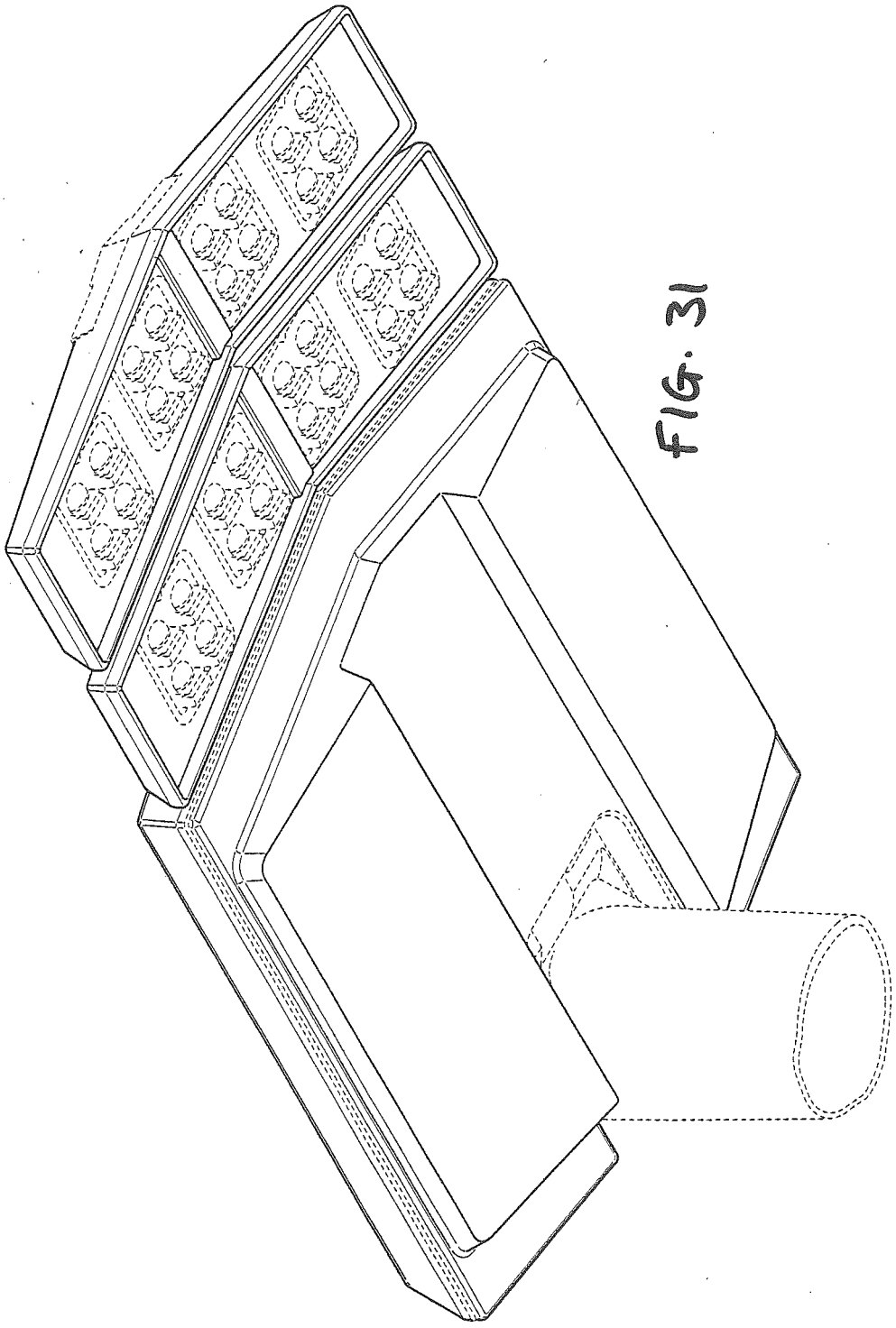


FIG. 31

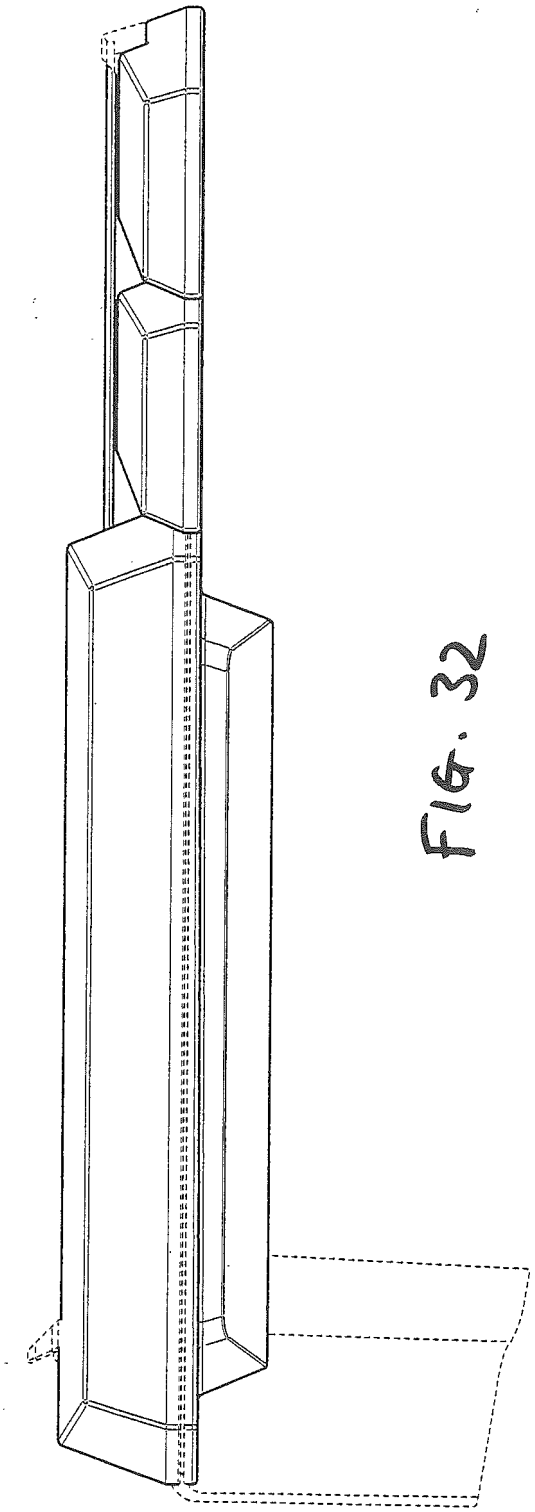


FIG. 32

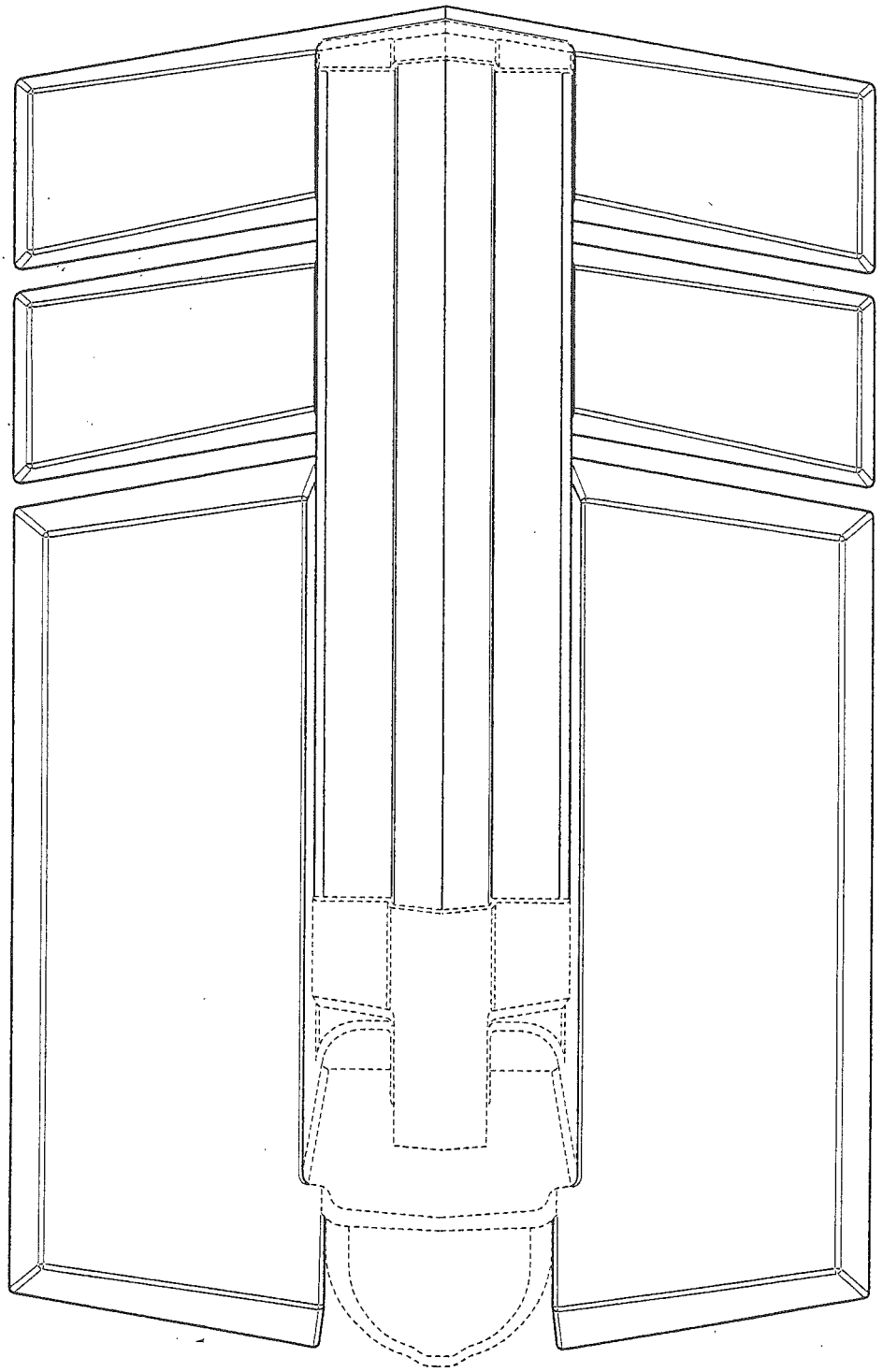


FIG. 33

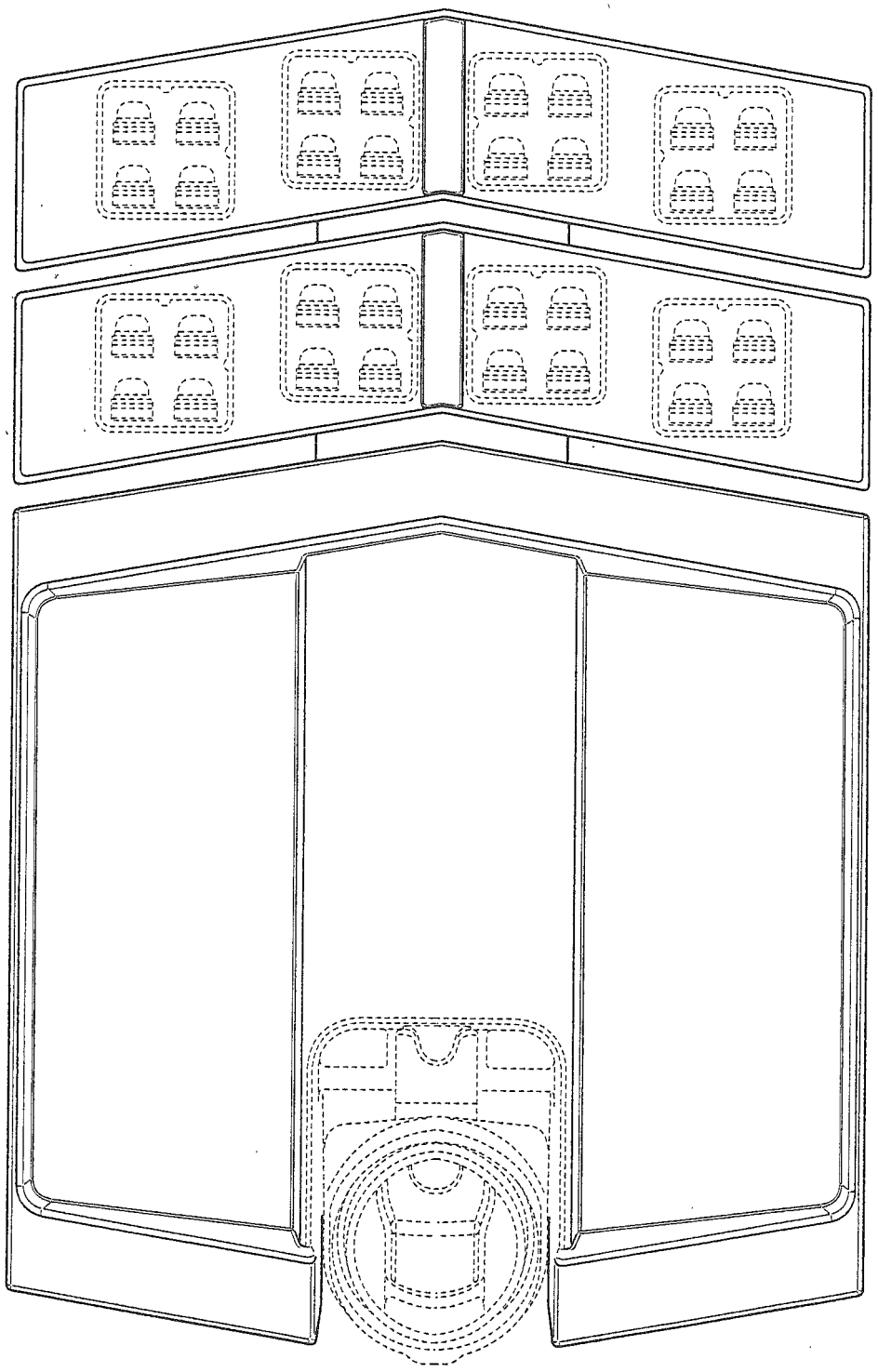


FIG. 34

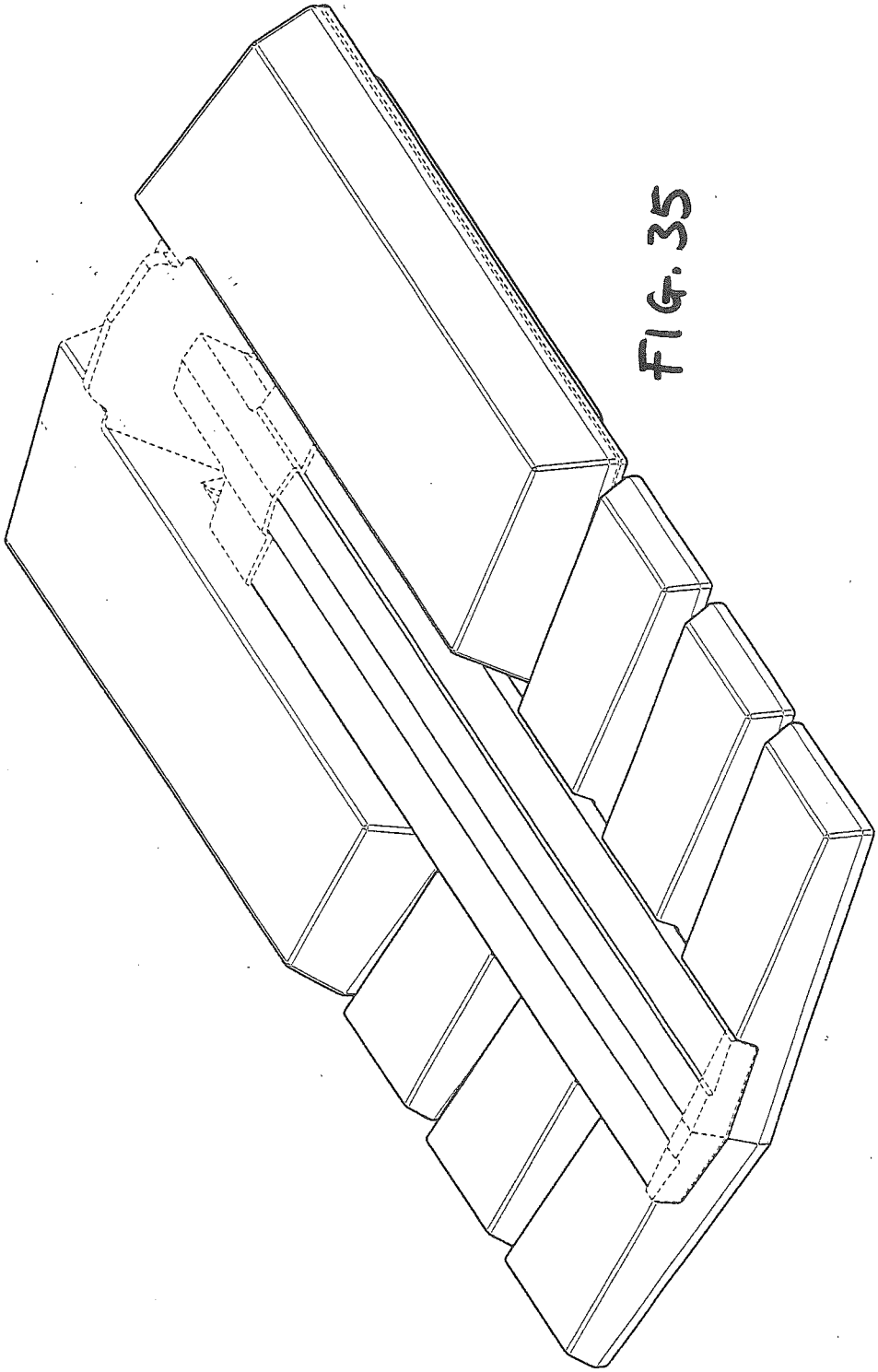


FIG. 35

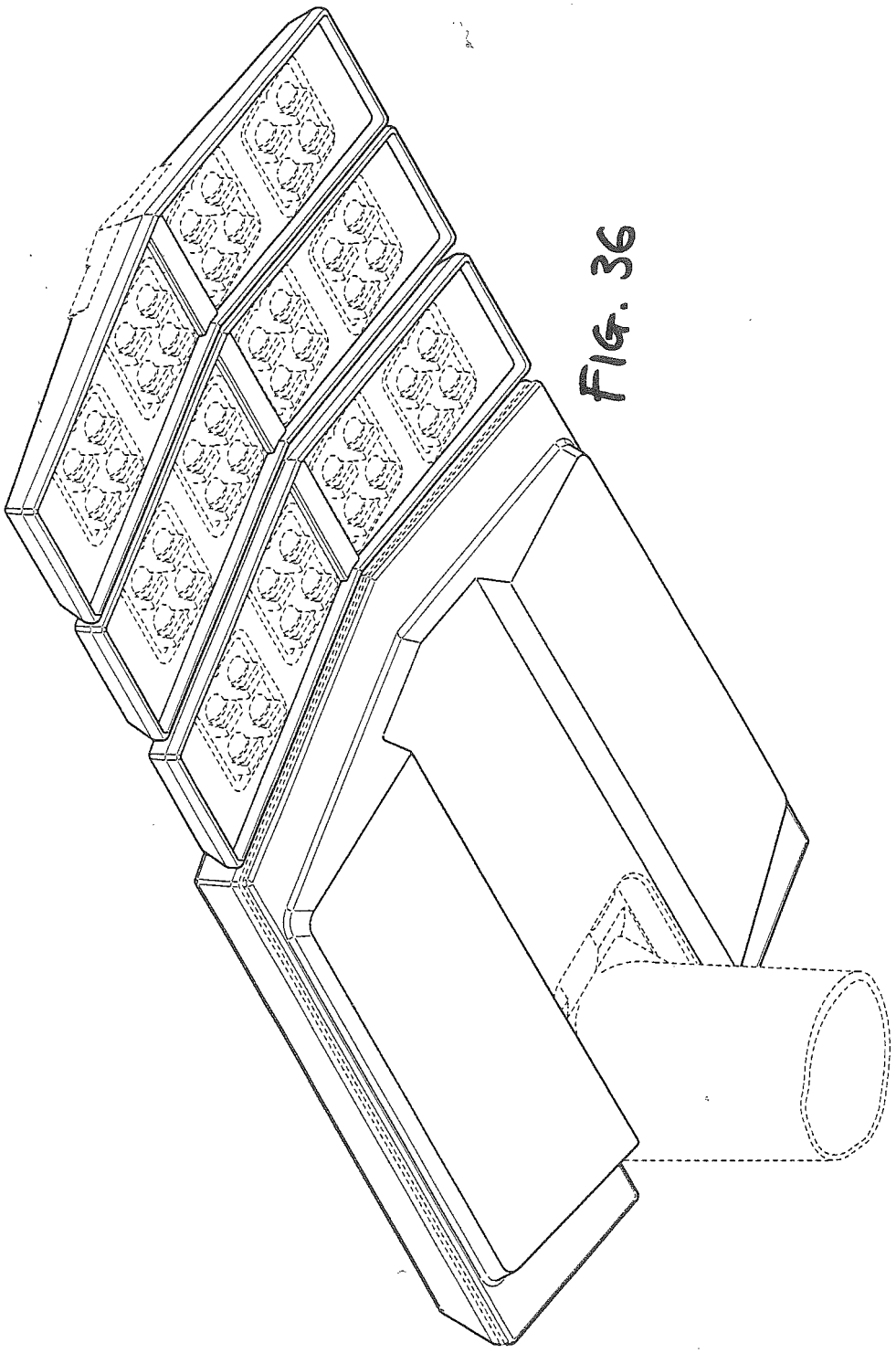


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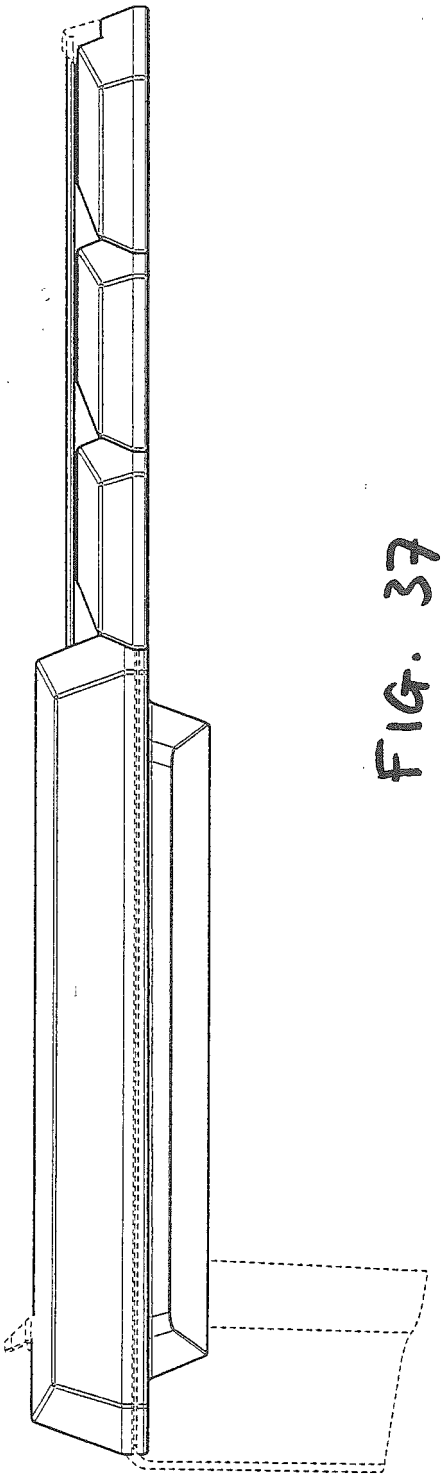
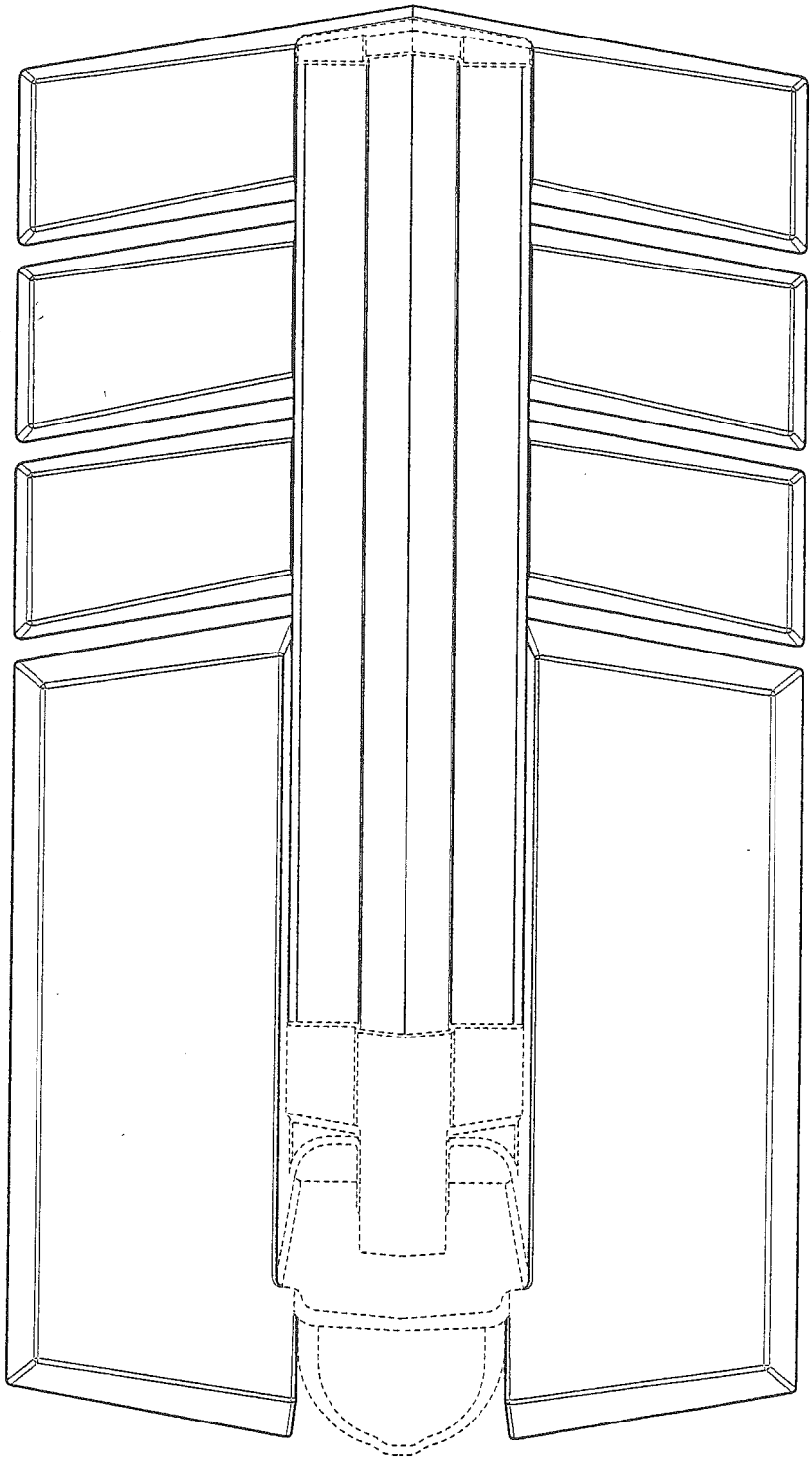


FIG. 37

FIG. 38



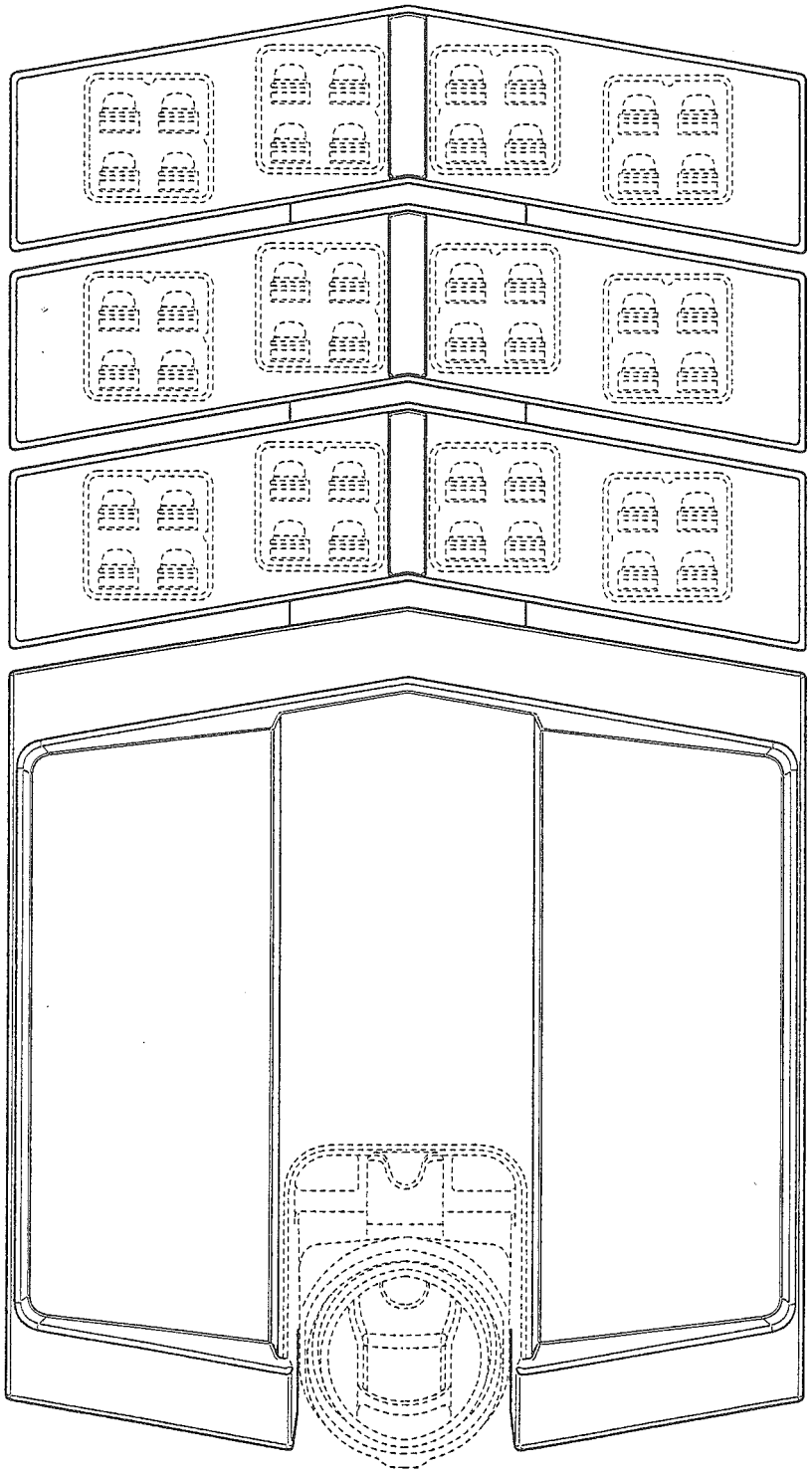


FIG. 39

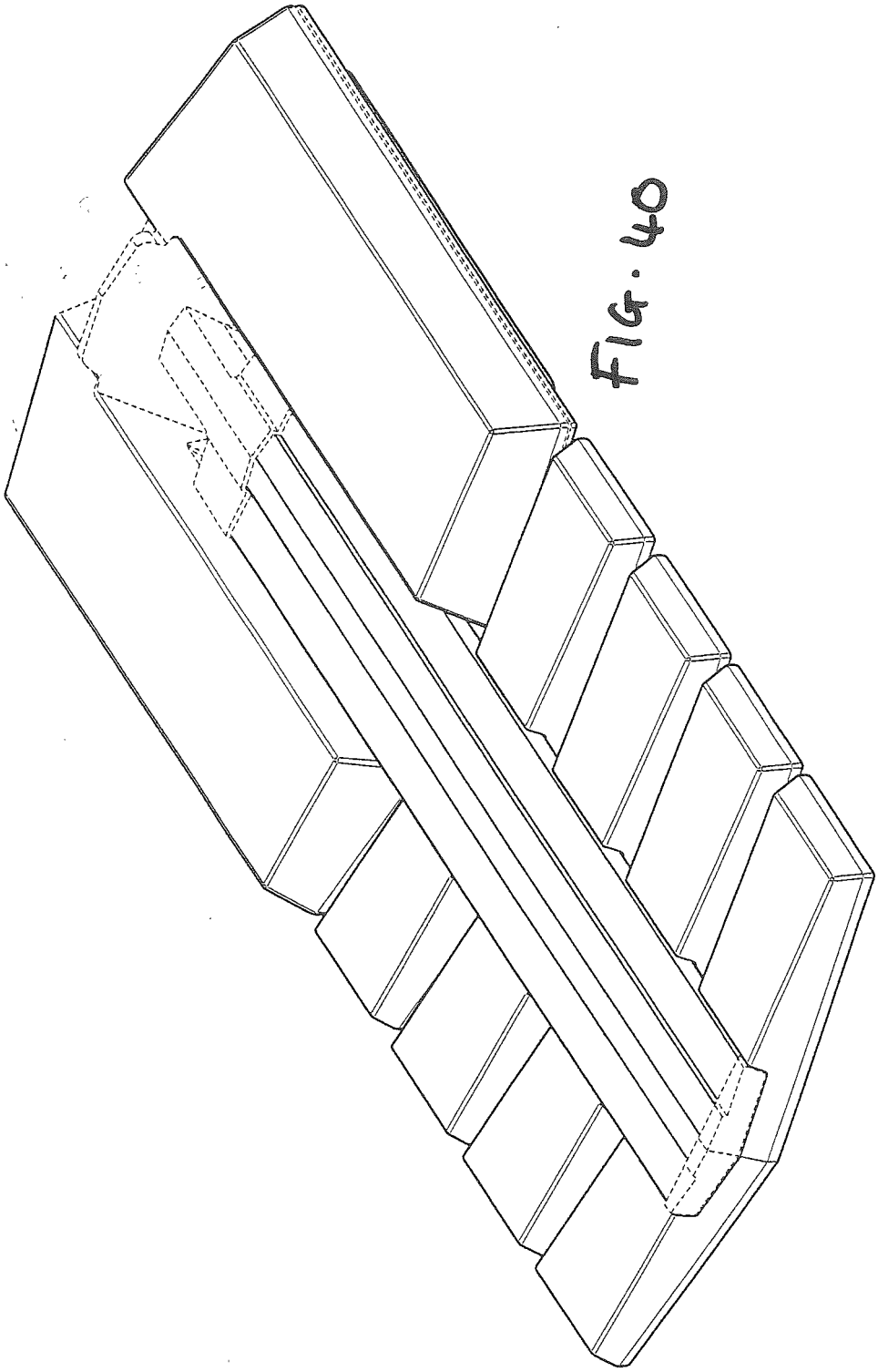


FIG. 40

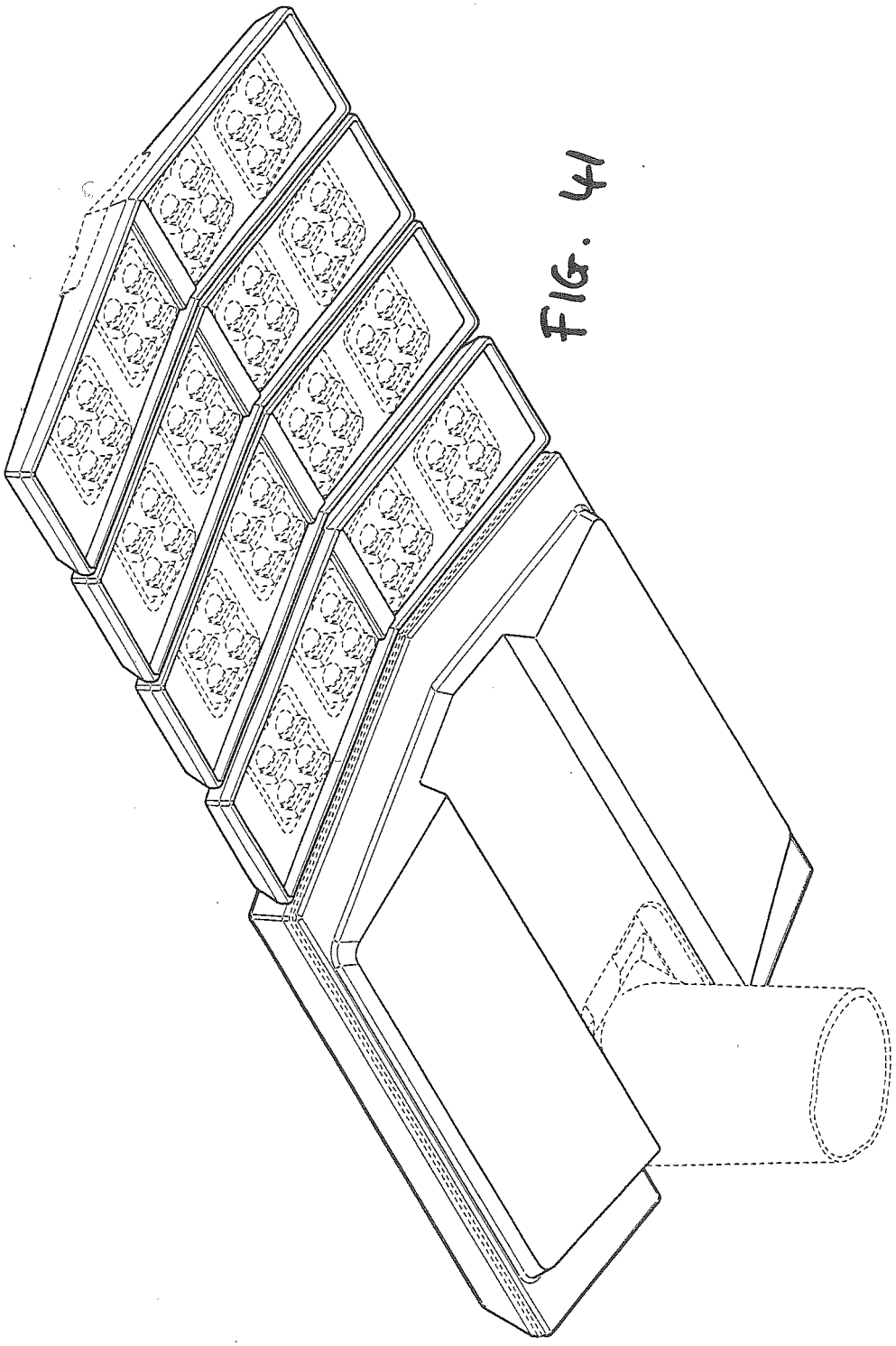


FIG. 41

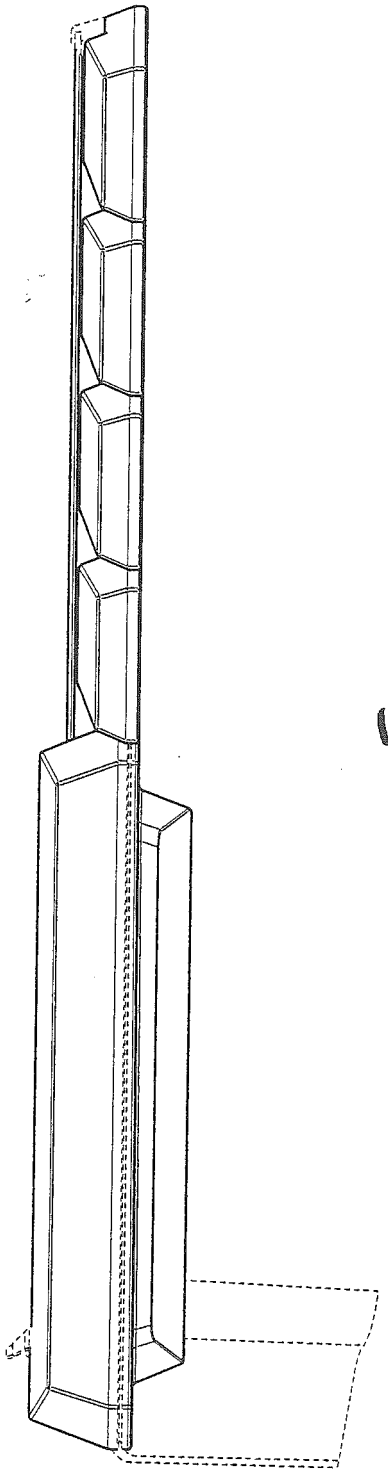


FIG. 42

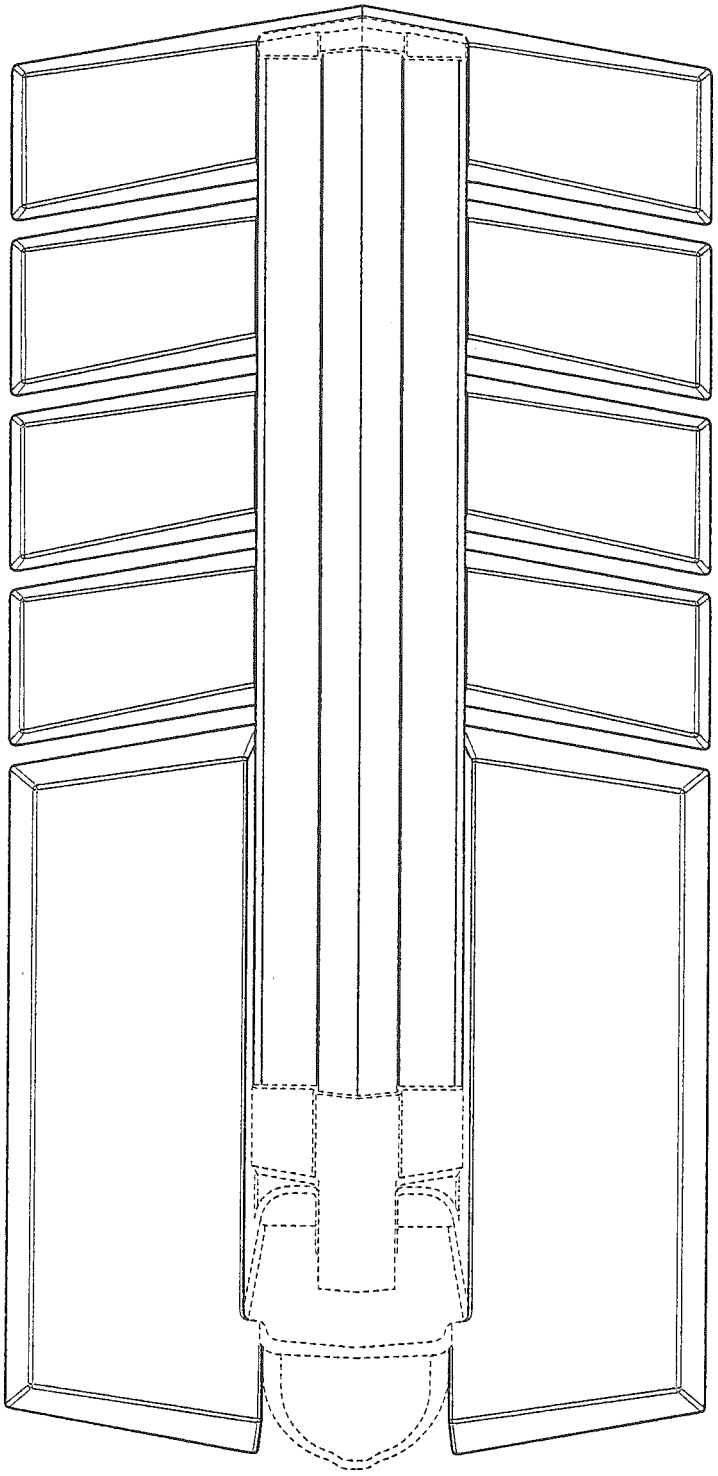


FIG. 43

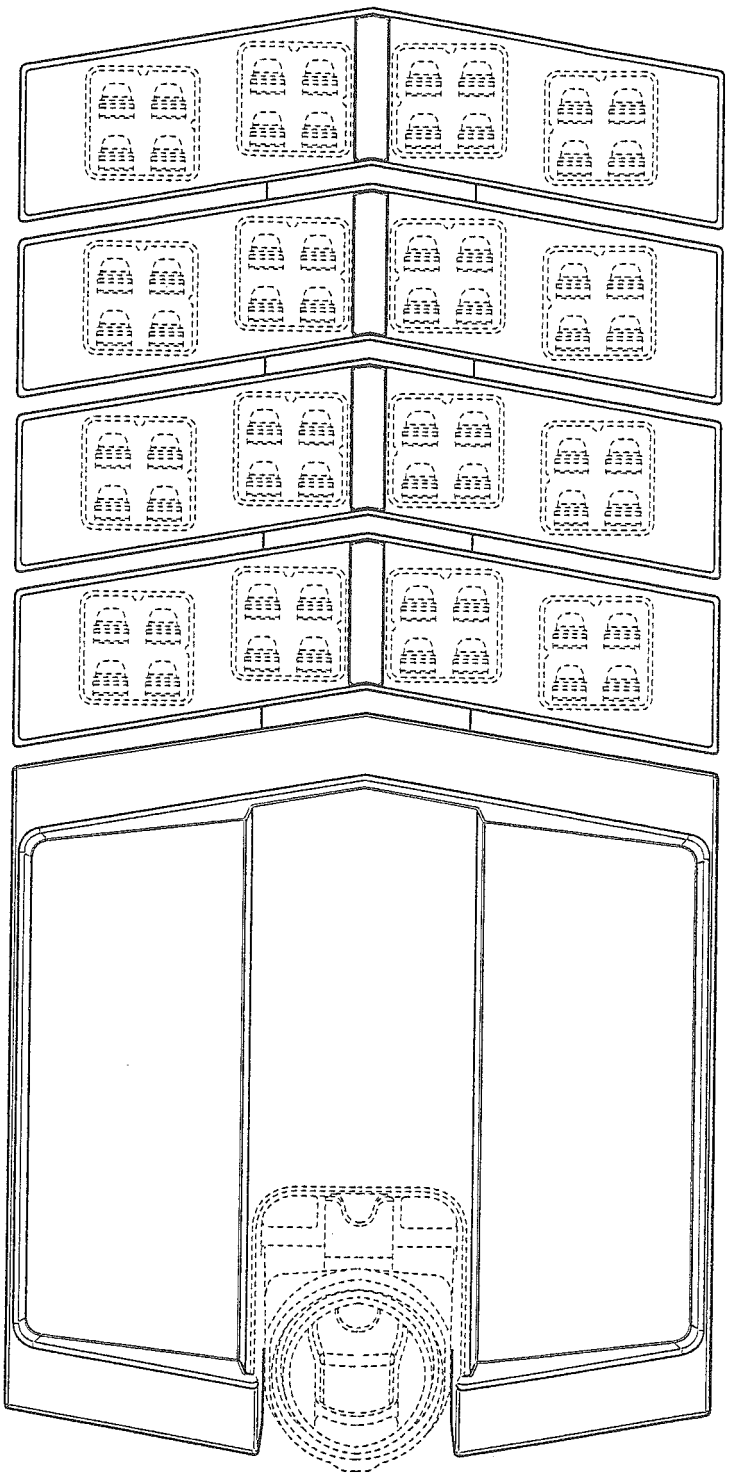


FIG. 44

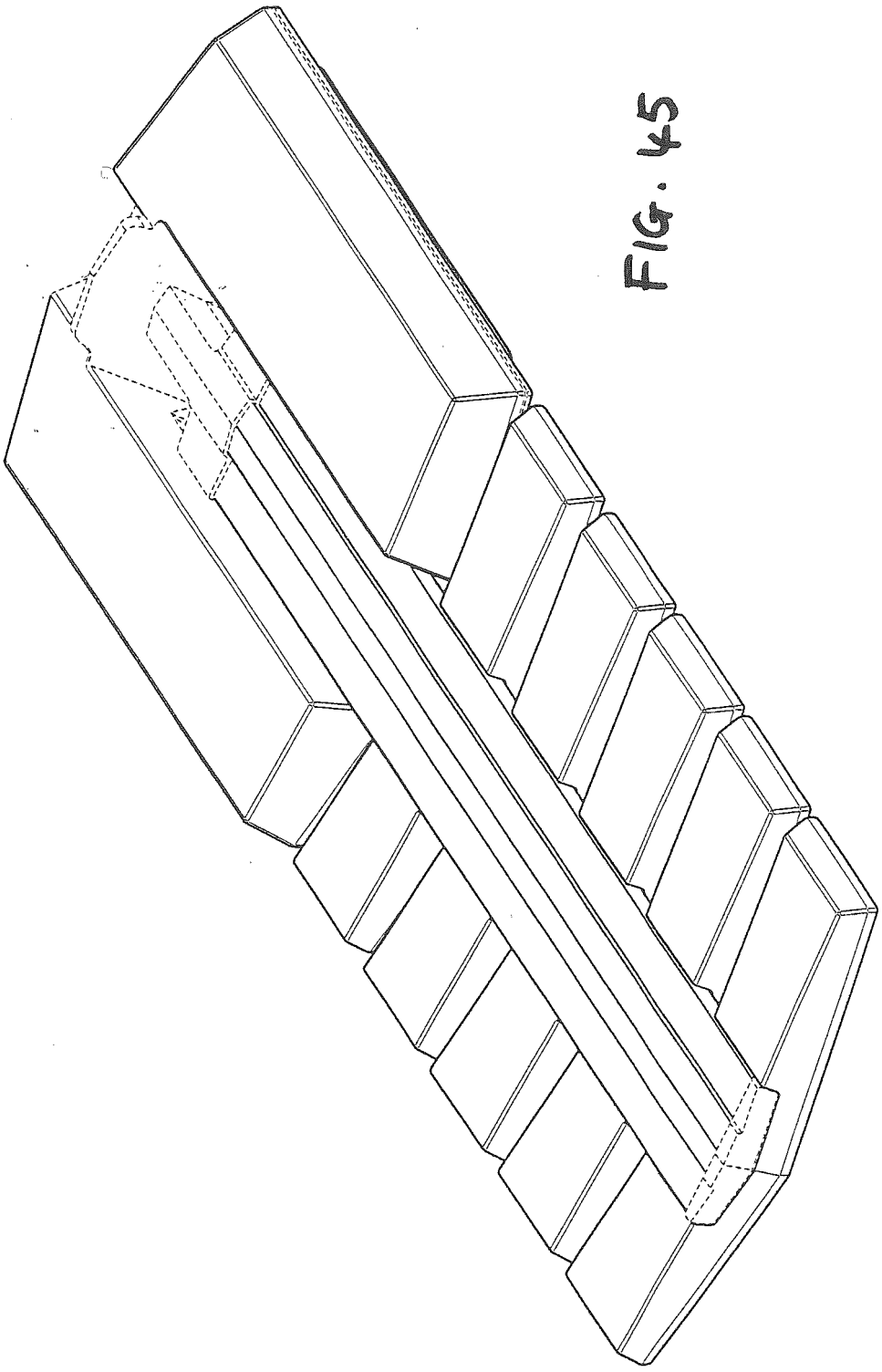


FIG. 45

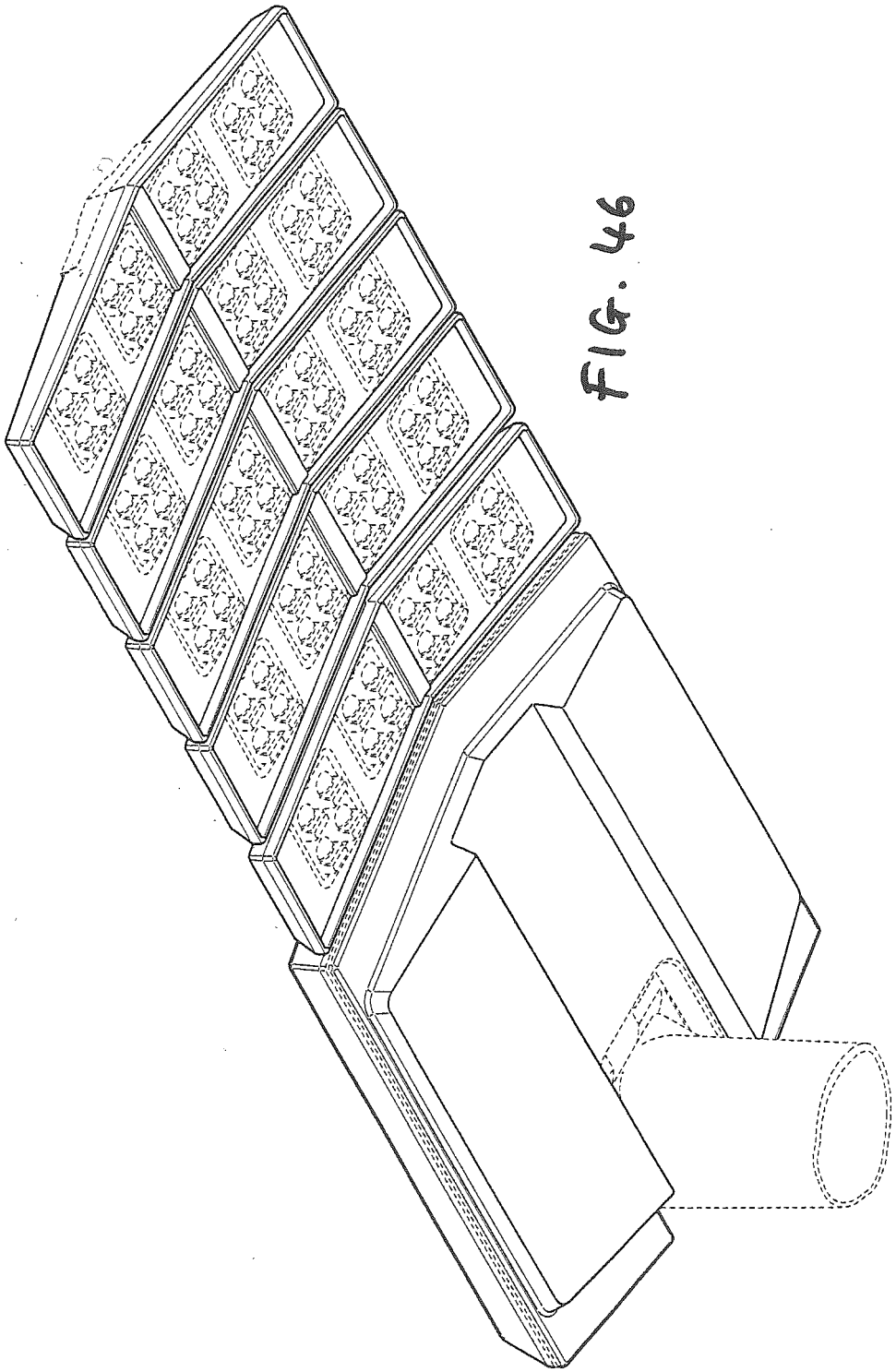


FIG. 46

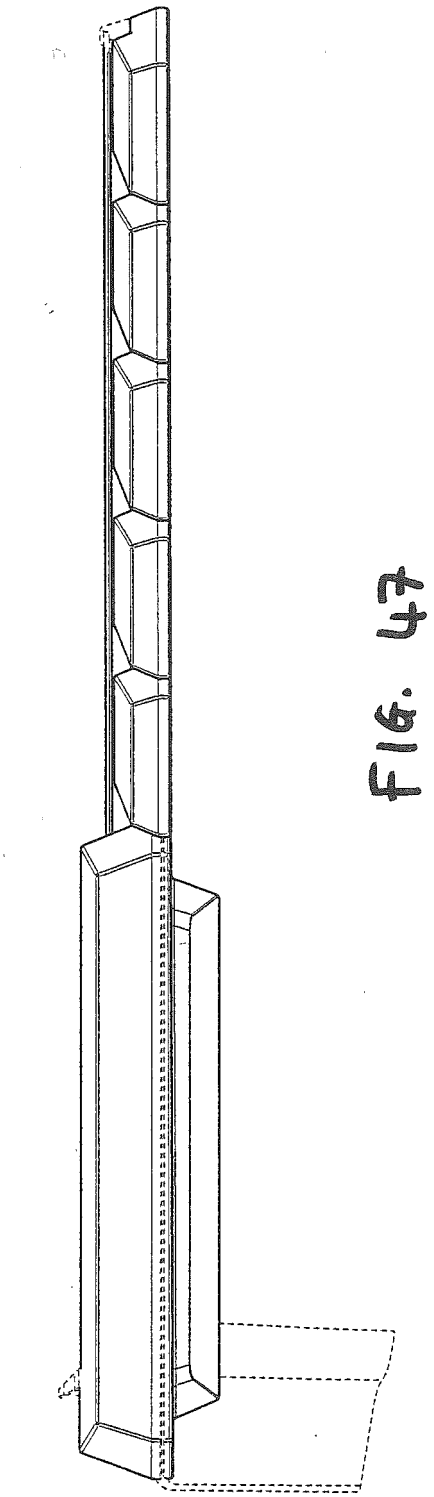


FIG. 47

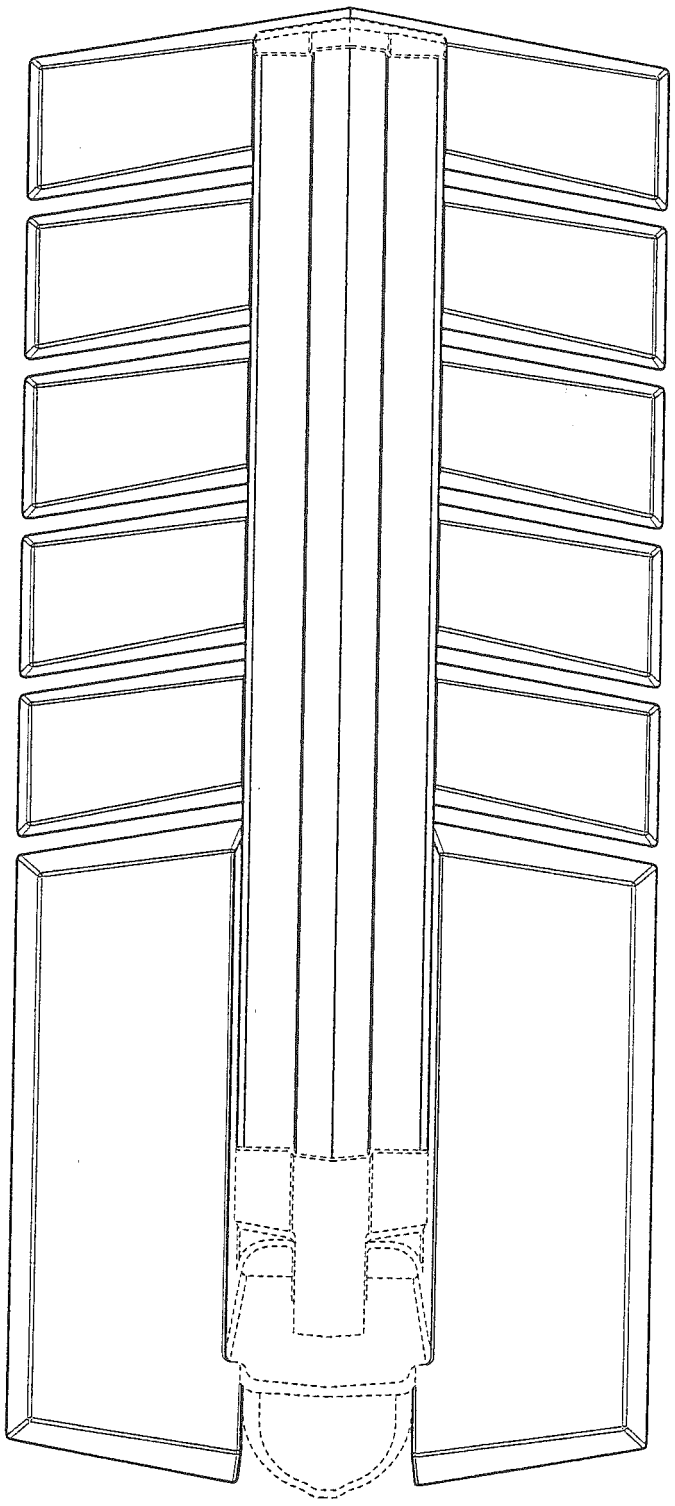


FIG. 48

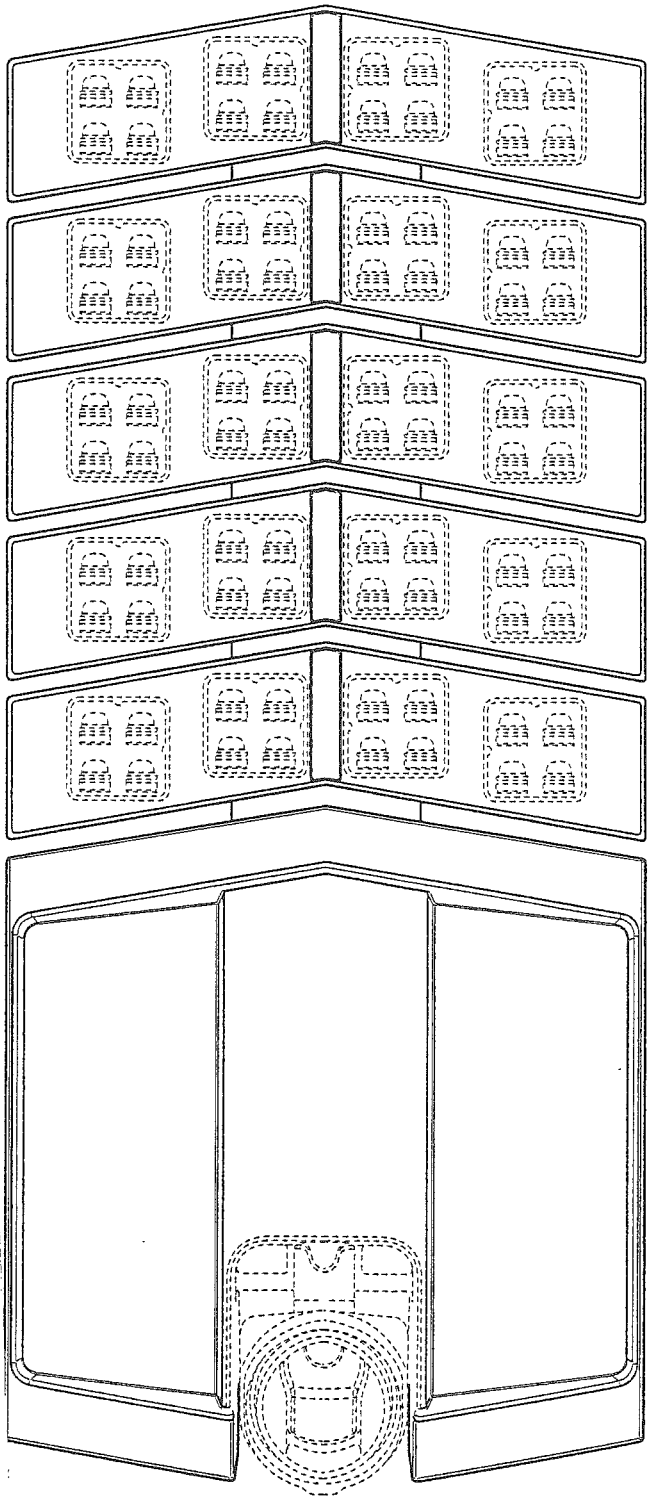


FIG. 49

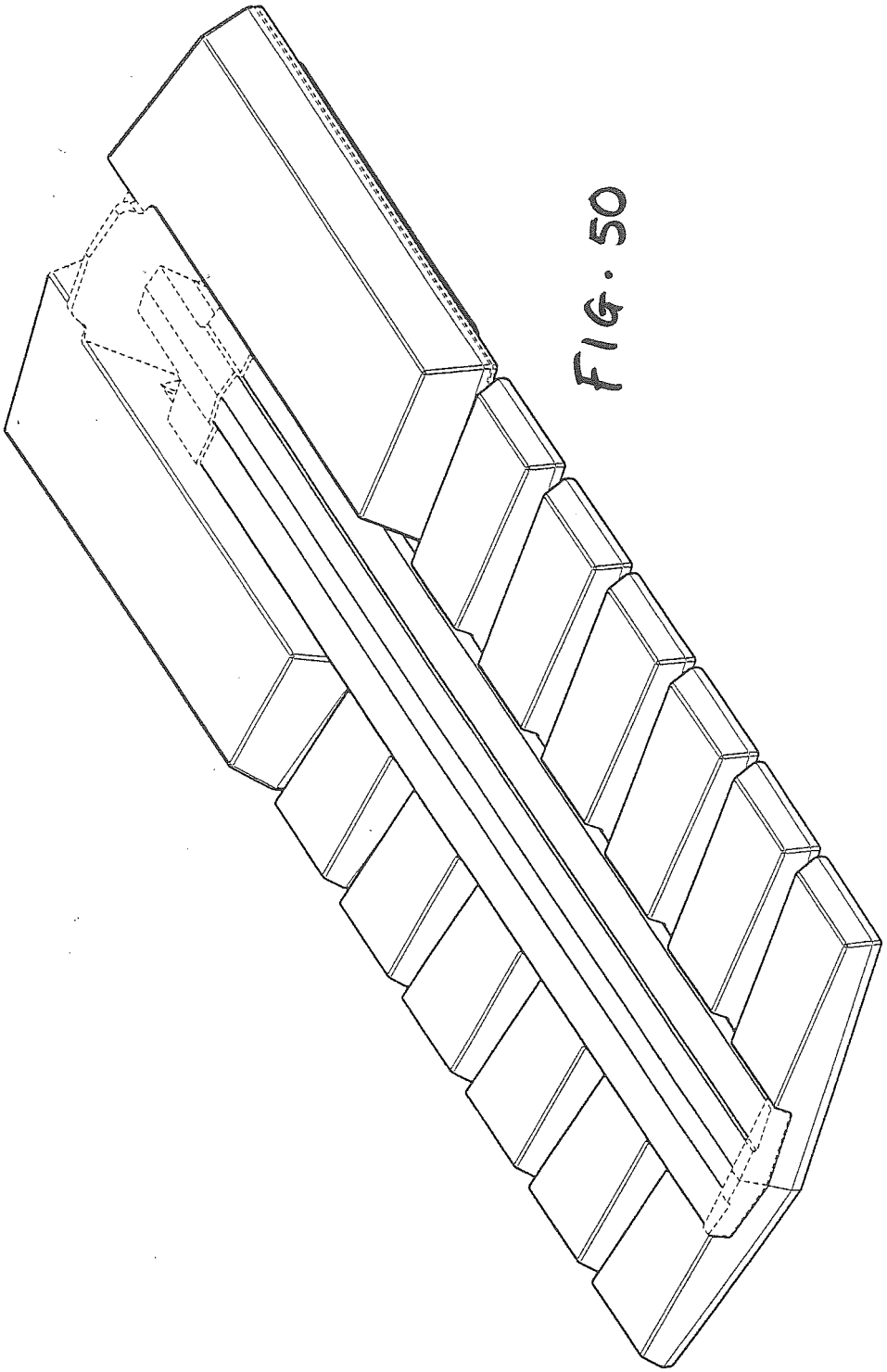


FIG. 50

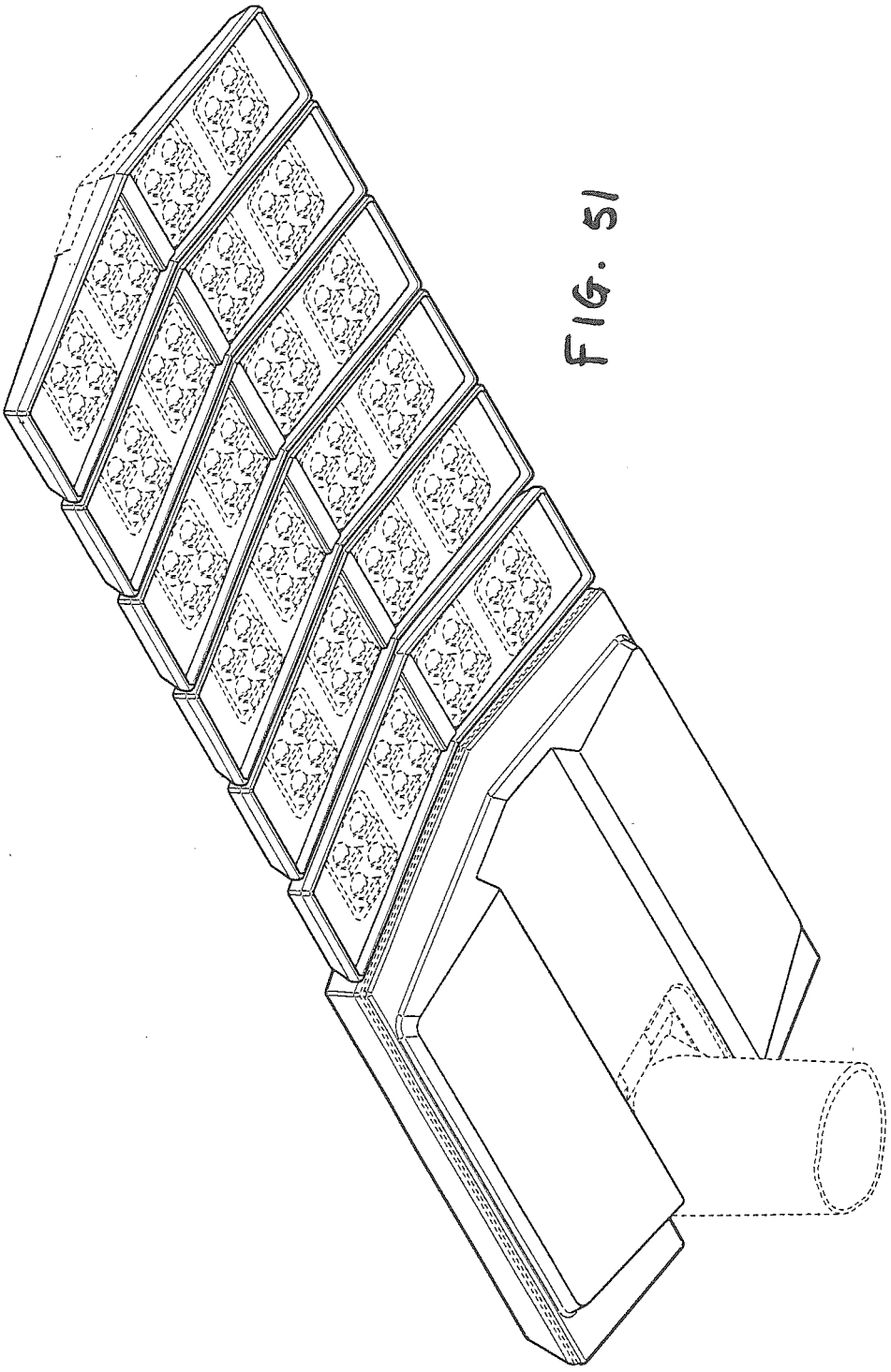


FIG. 51

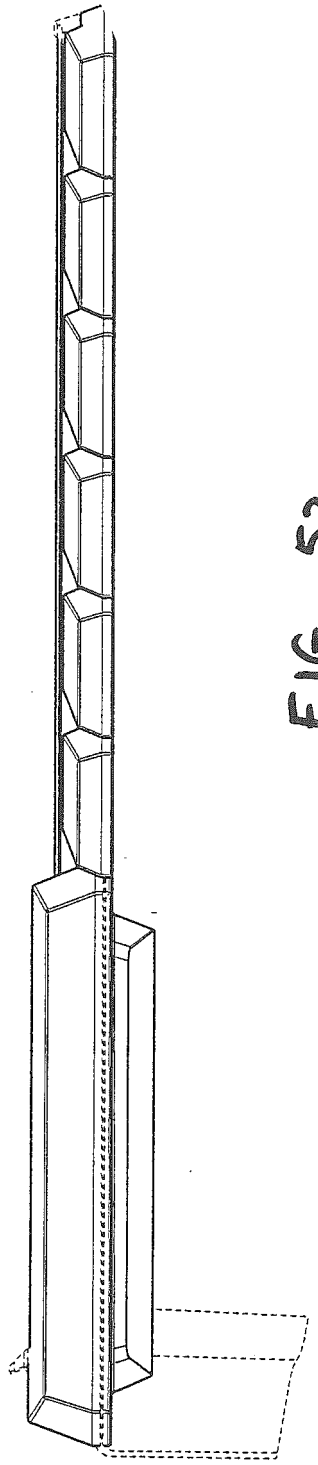


FIG. 52

FIG. 53

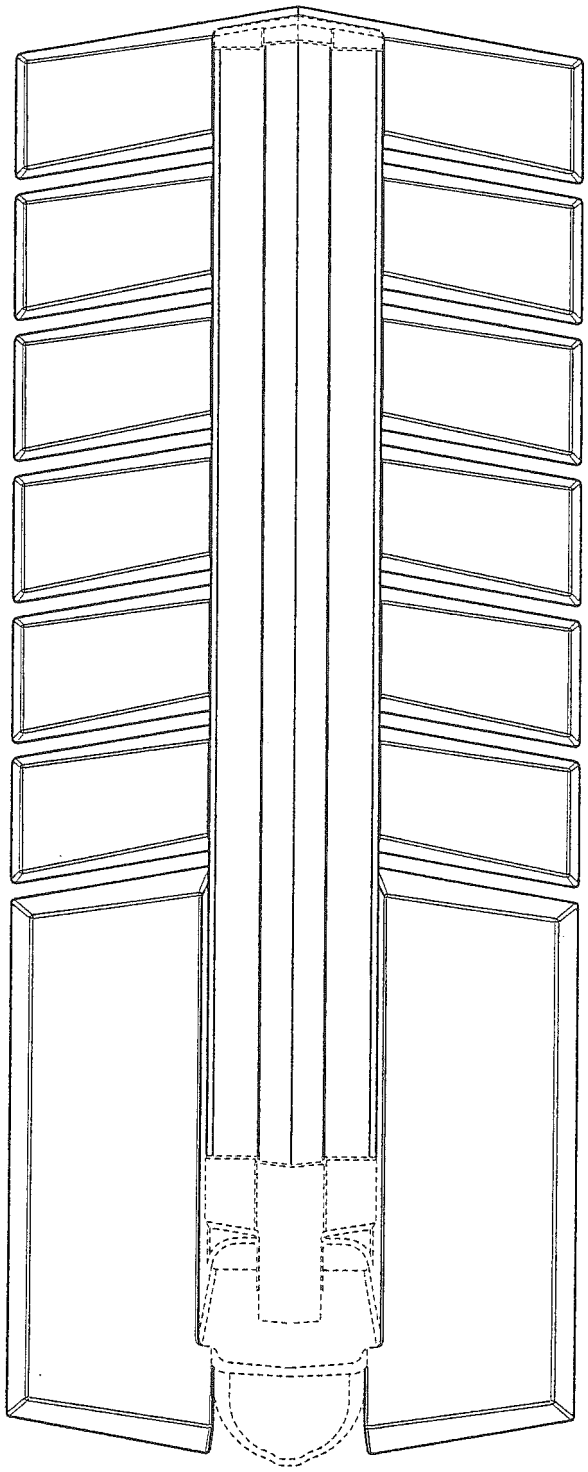
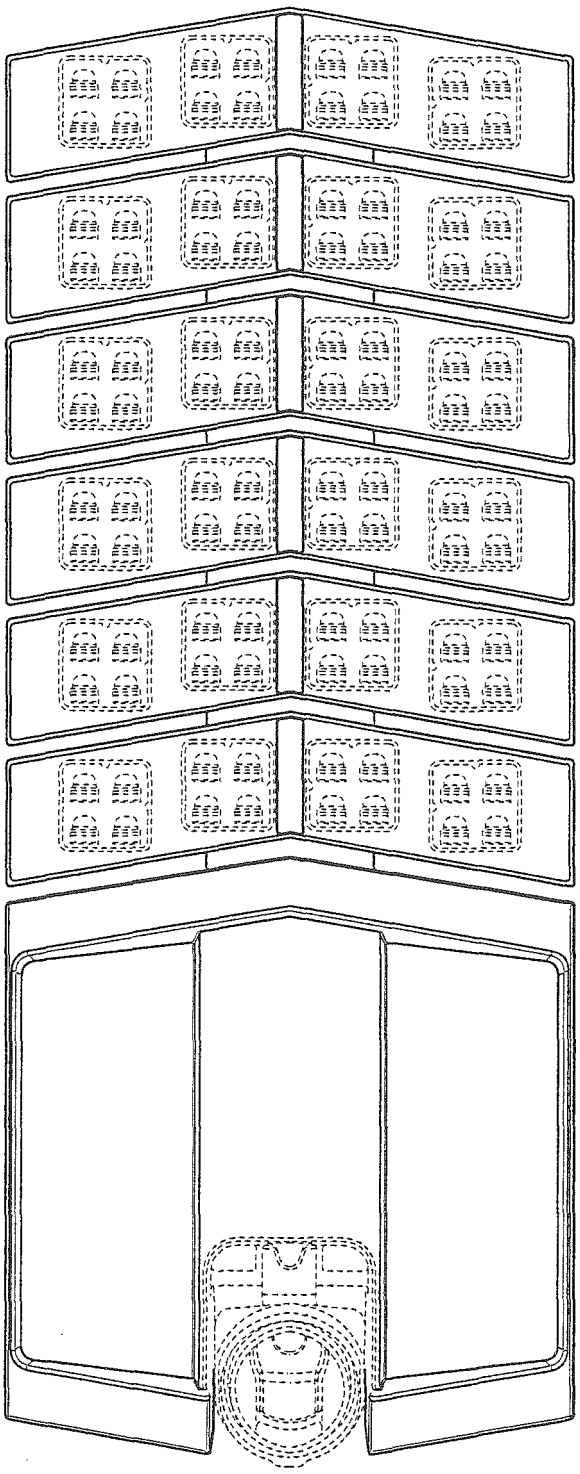


FIG. 54



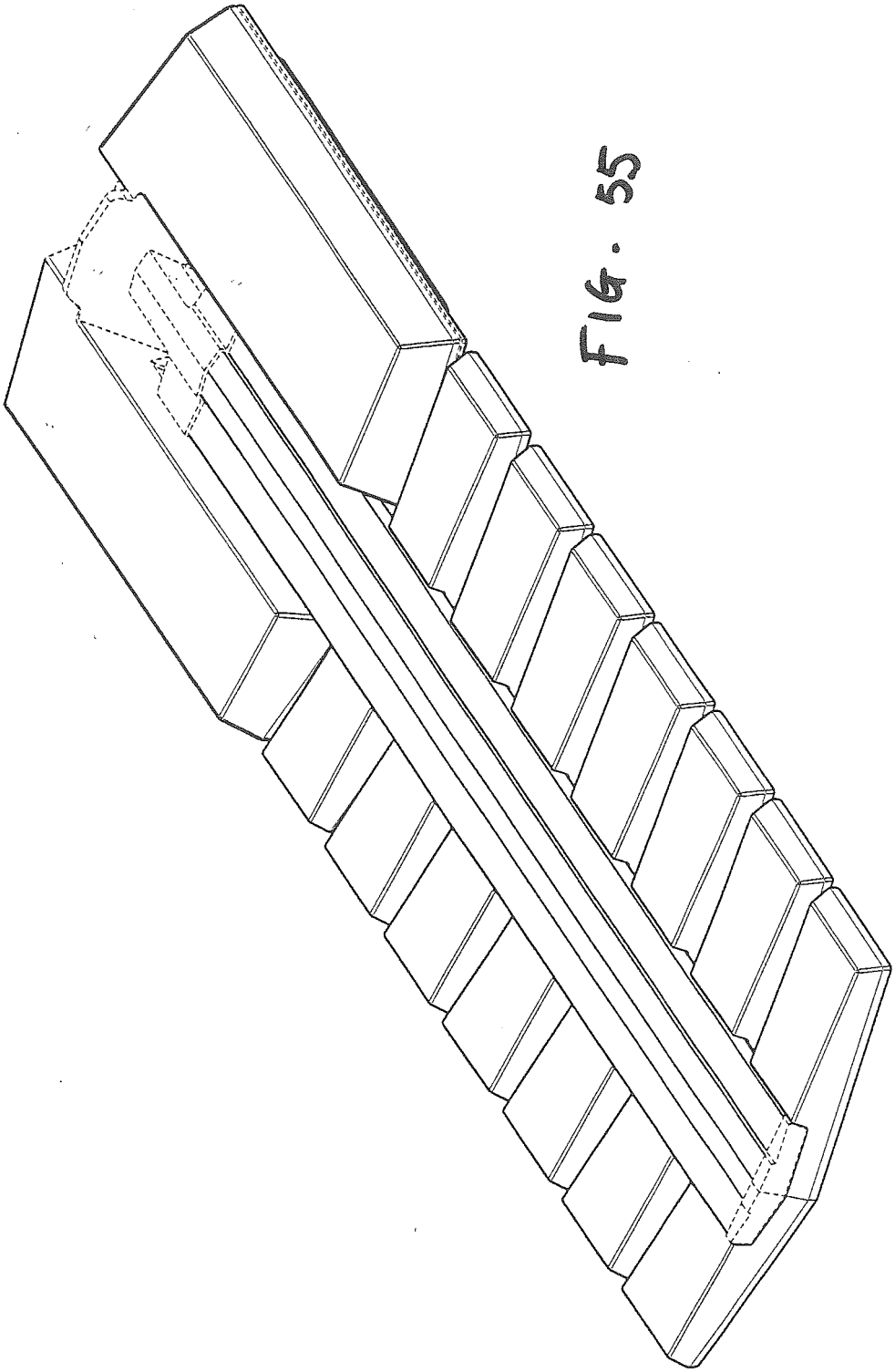


FIG. 55

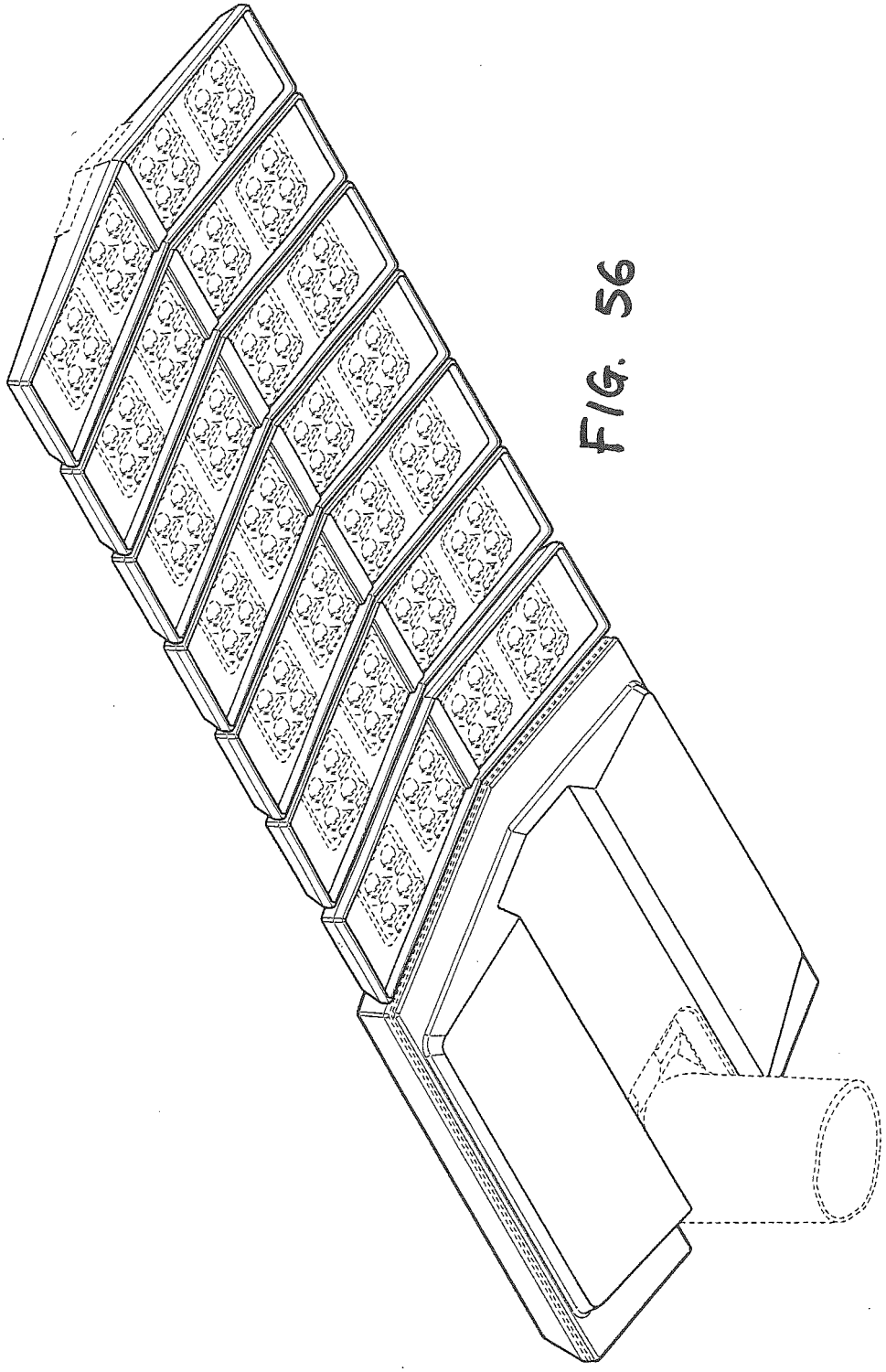


FIG. 56

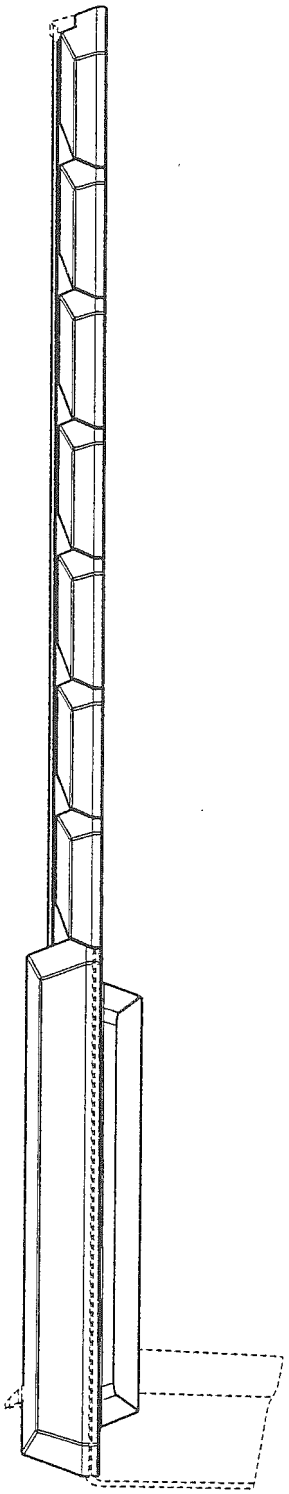


FIG. 57

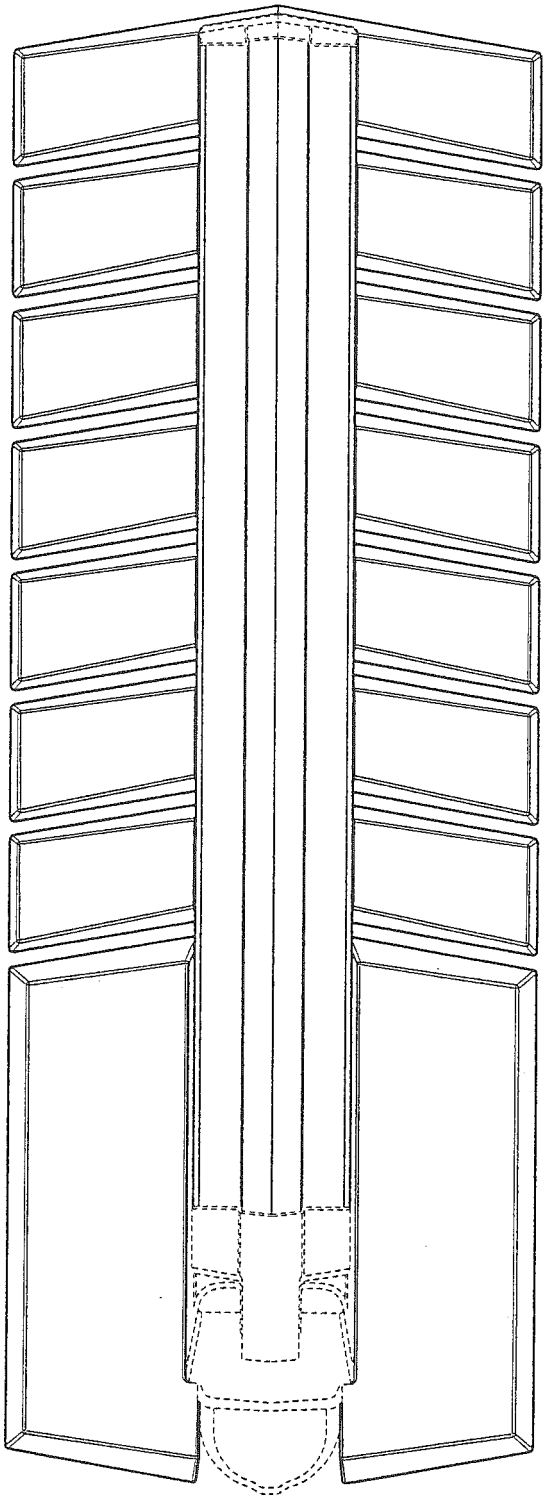


FIG. 58

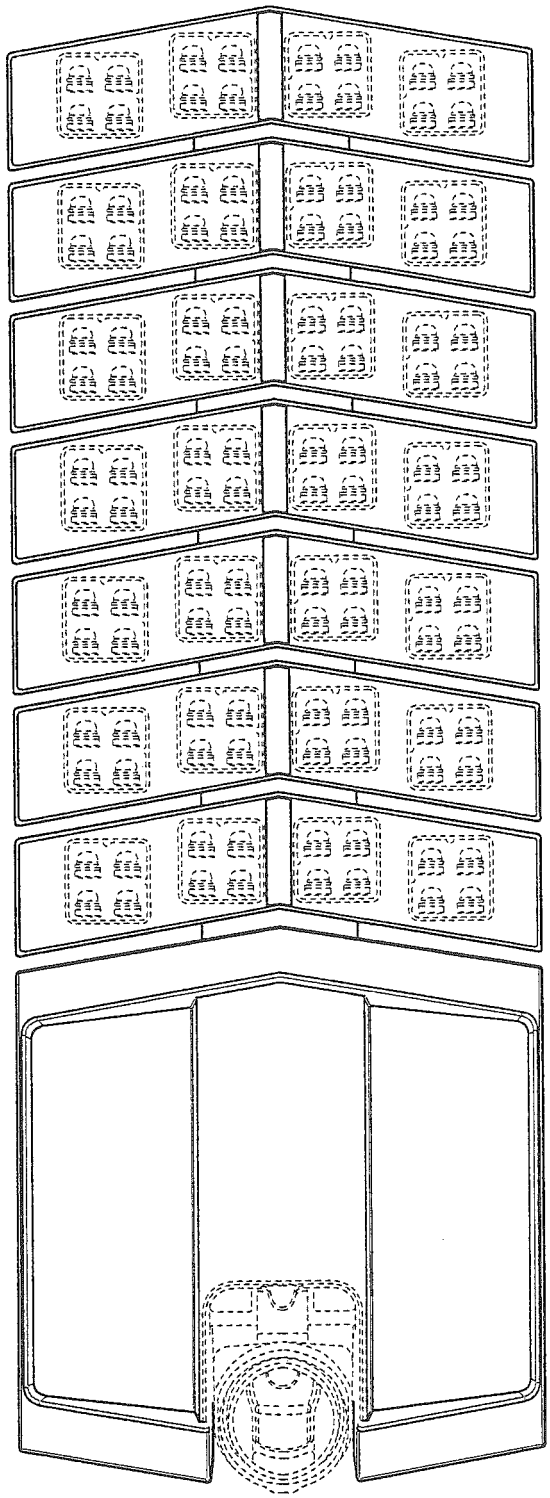


FIG. 59

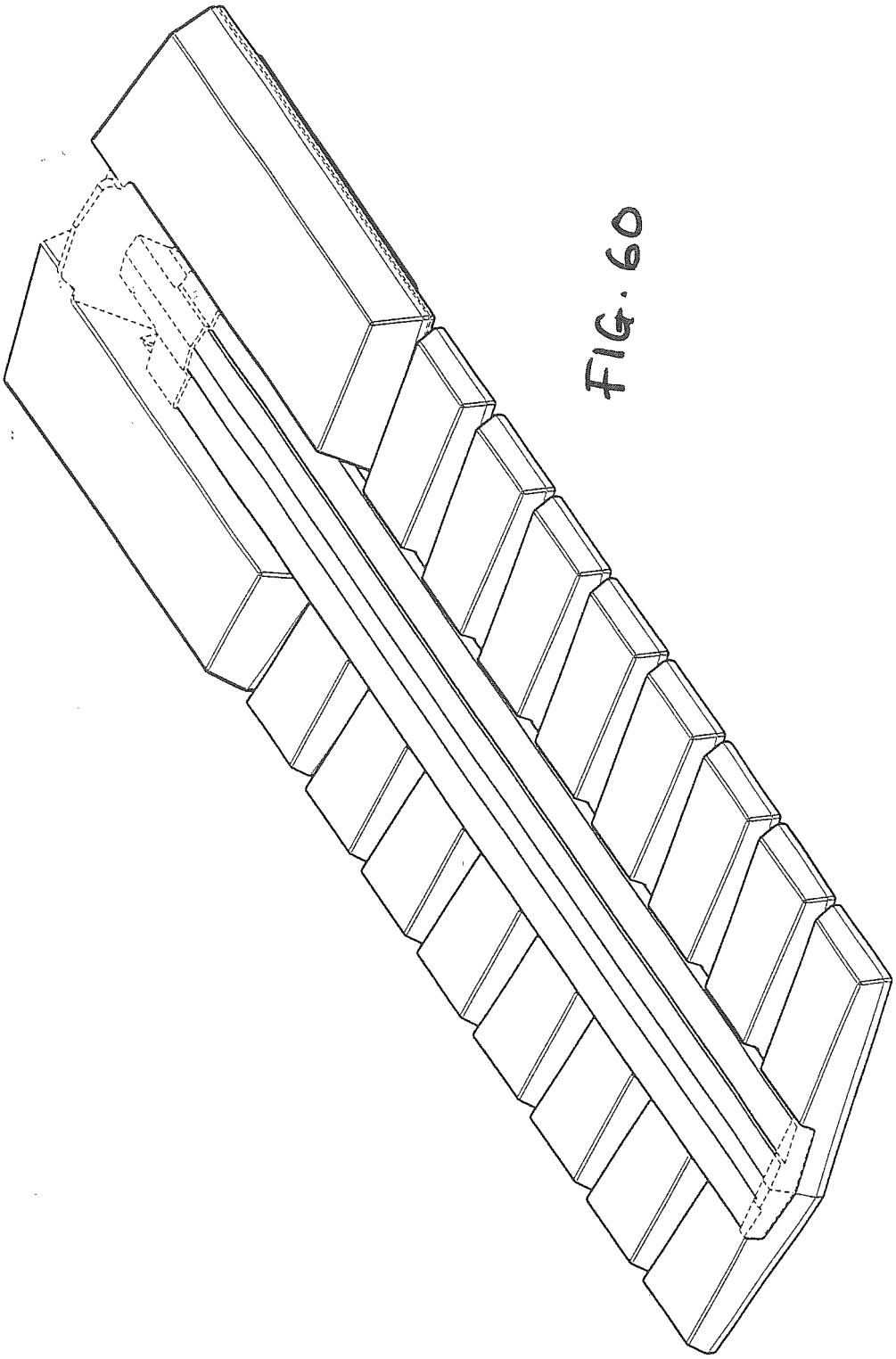


FIG. 60

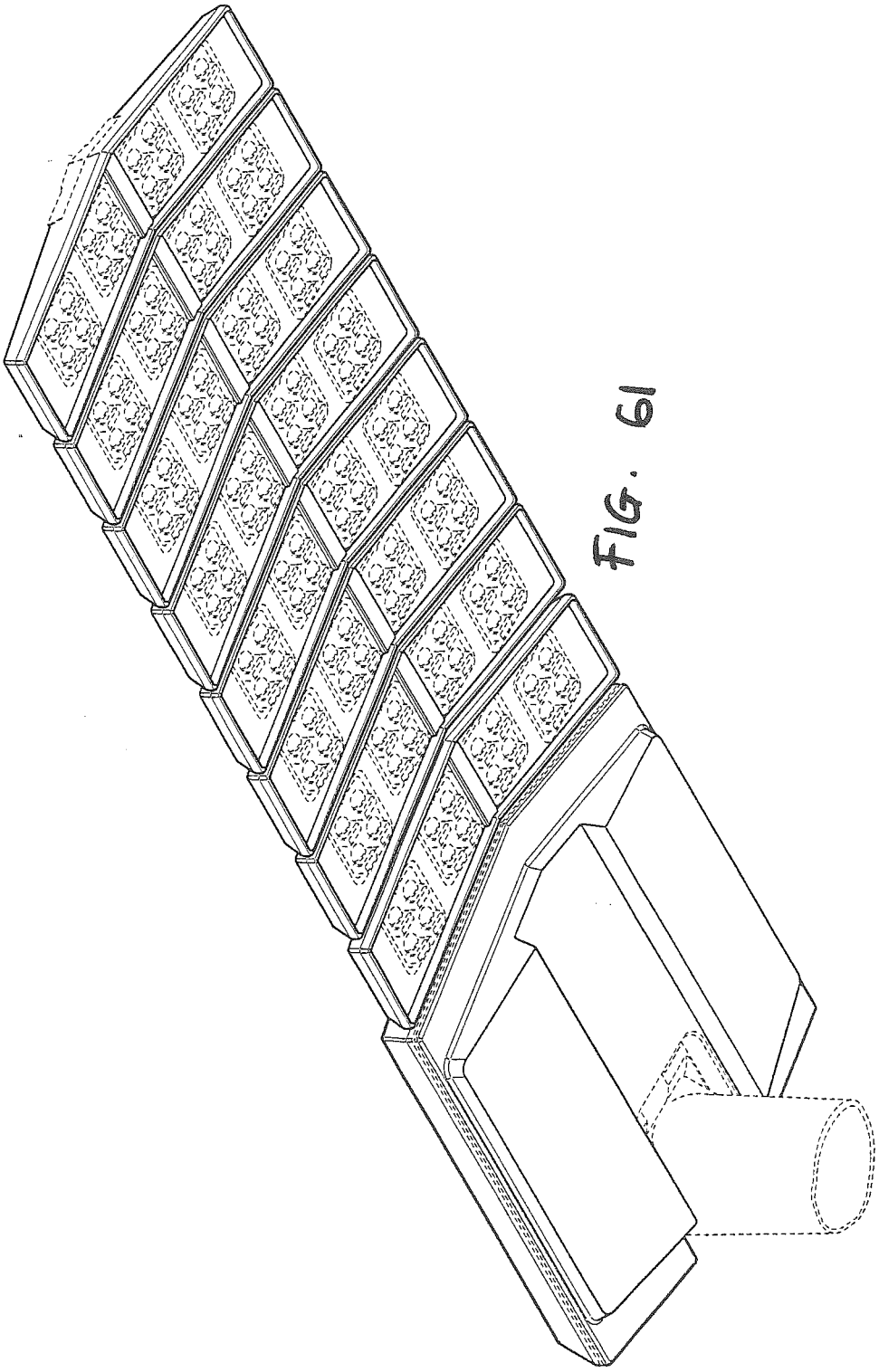


FIG. 61

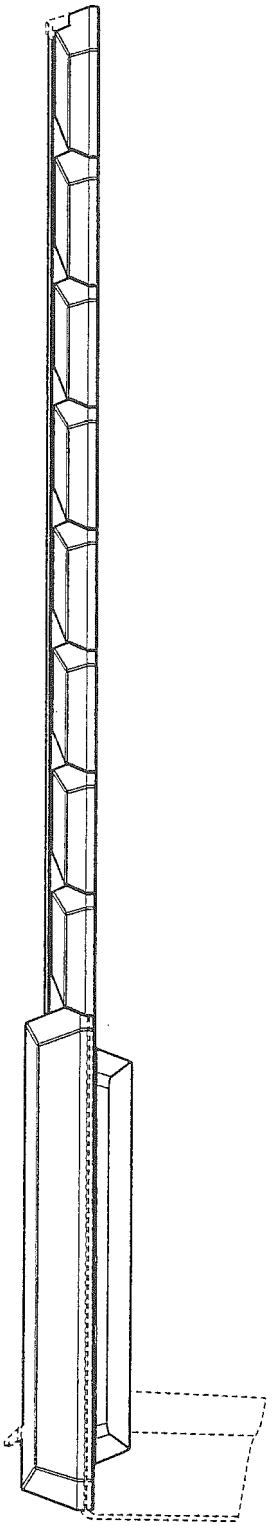
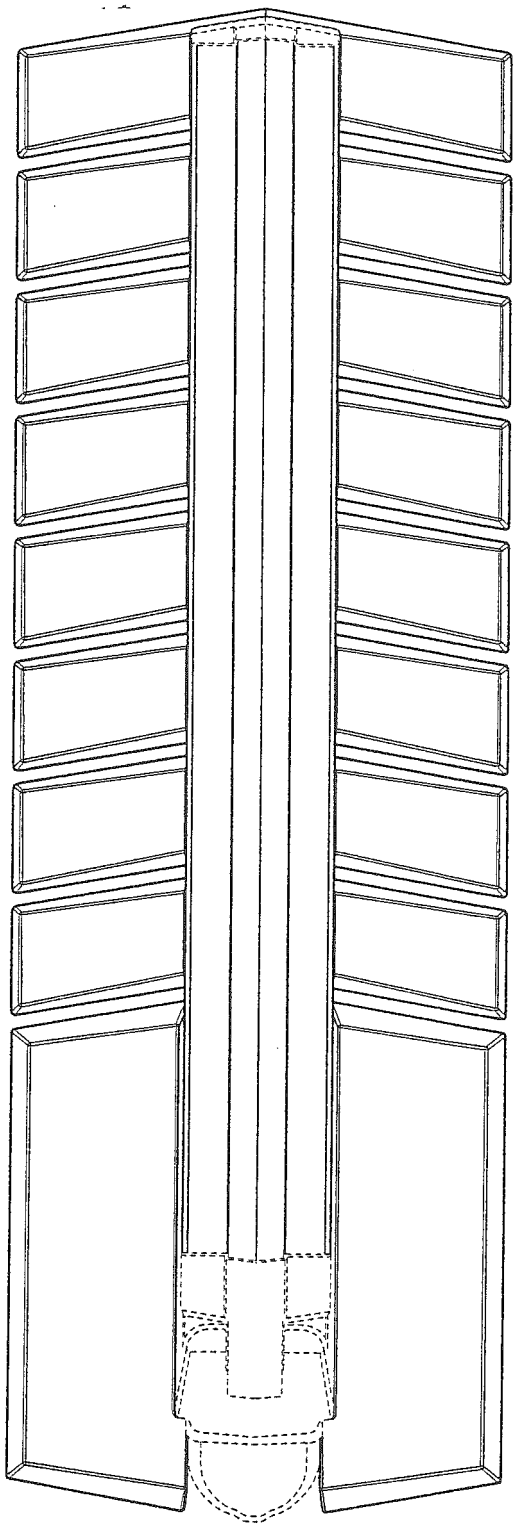


FIG. 62

FIG. 63



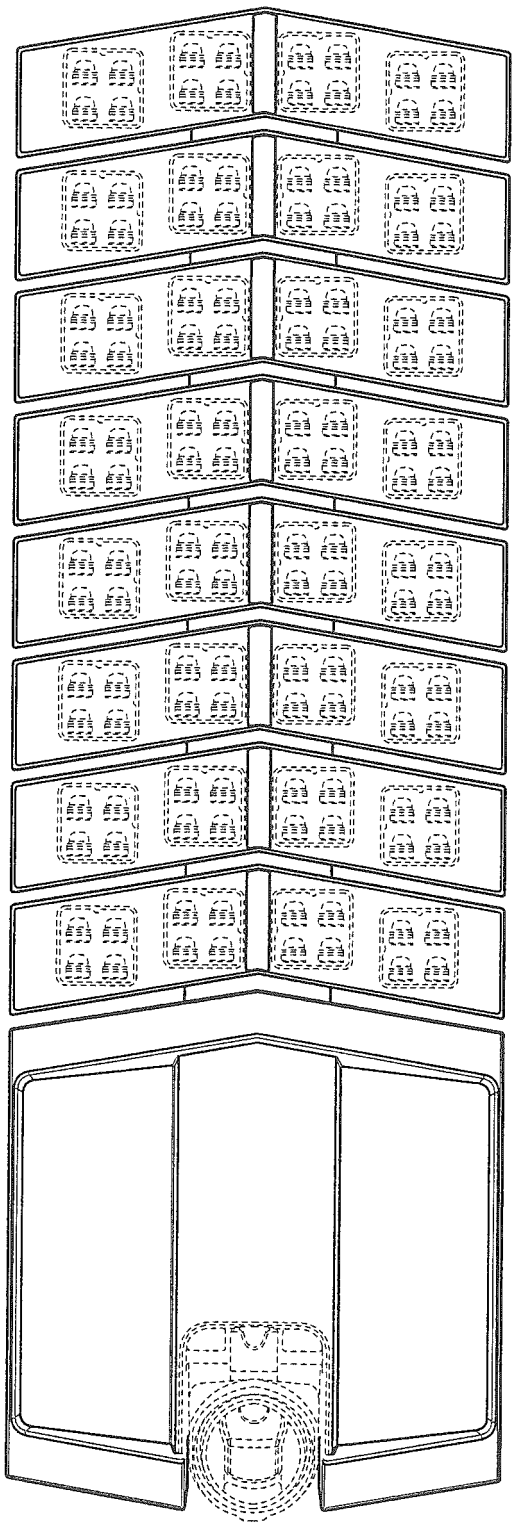


FIG. 64

REFERENCES CITED IN THE DESCRIPTION

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