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(54) **VACUUM COATING SYSTEM**

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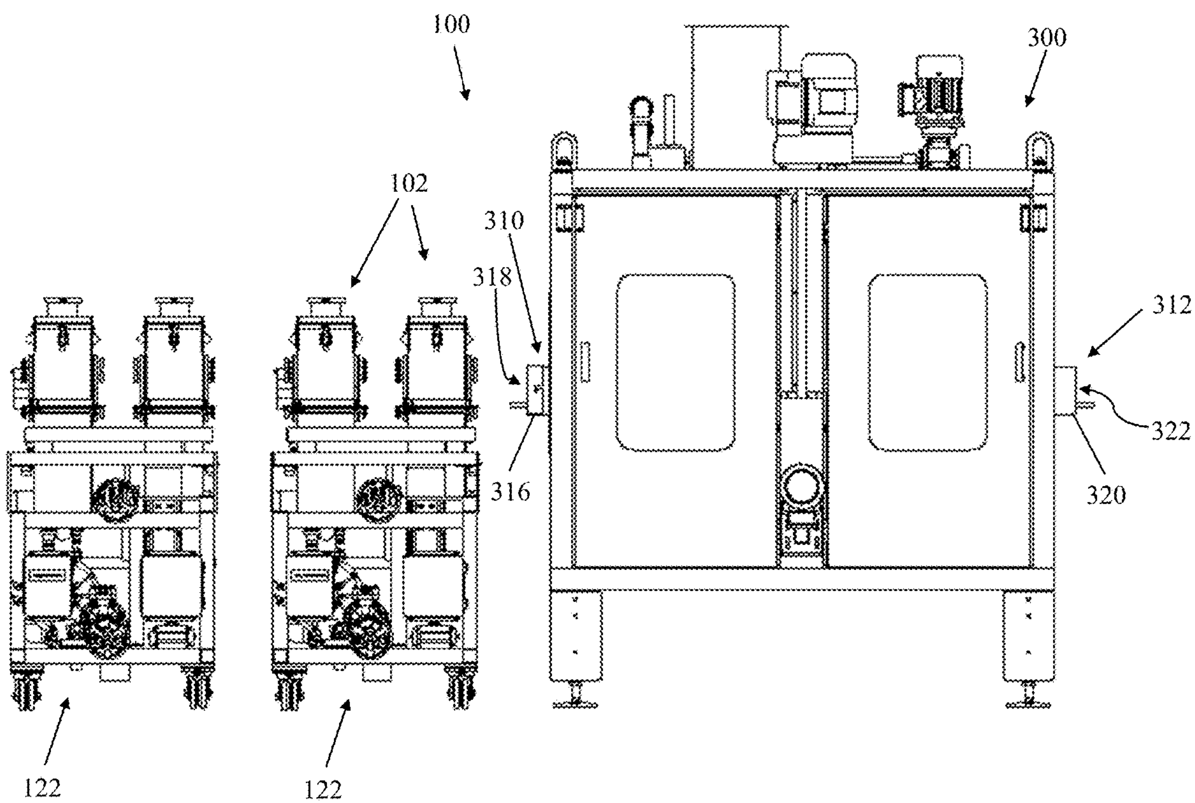
(57) **ABSTRACT**

A vacuum coating system includes a vacuum head assembly for applying a coating to a part traveling therethrough. In one embodiment, the vacuum head assembly includes an internal filtration system. In another embodiment, the vacuum head assembly is split about apertures through which the part travels such that an upper portion of the vacuum head assembly can be separated (e.g., hinged upwardly) from a lower portion of the vacuum head assembly. In one embodiment, the system includes a light curing system that includes a plurality of longitudinally extending light sources arrayed radially about the part traveling therethrough along the longitudinal axis. The light sources emit light to cure the coating on the part as it passes through the light curing system.



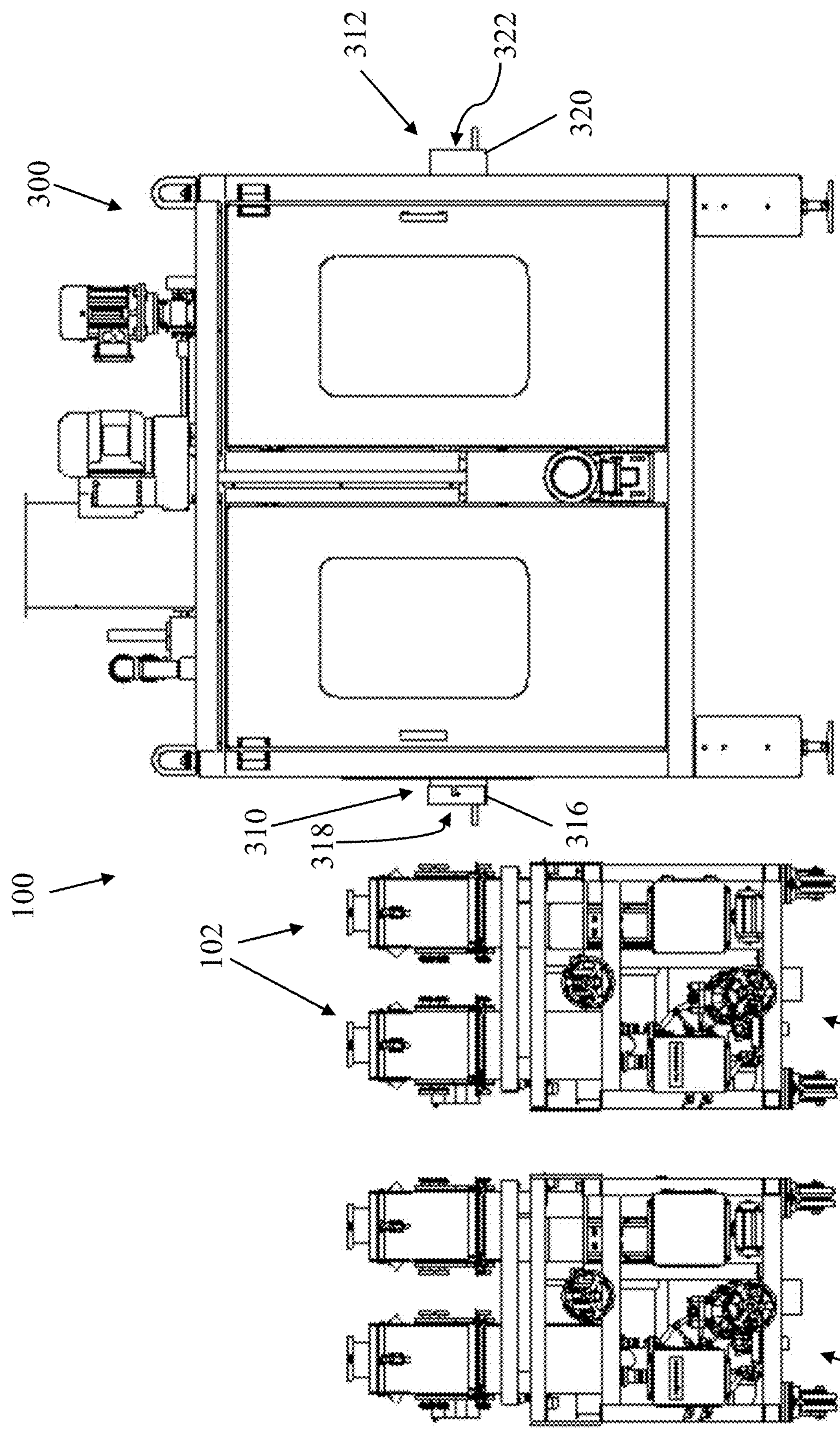


FIG. 1

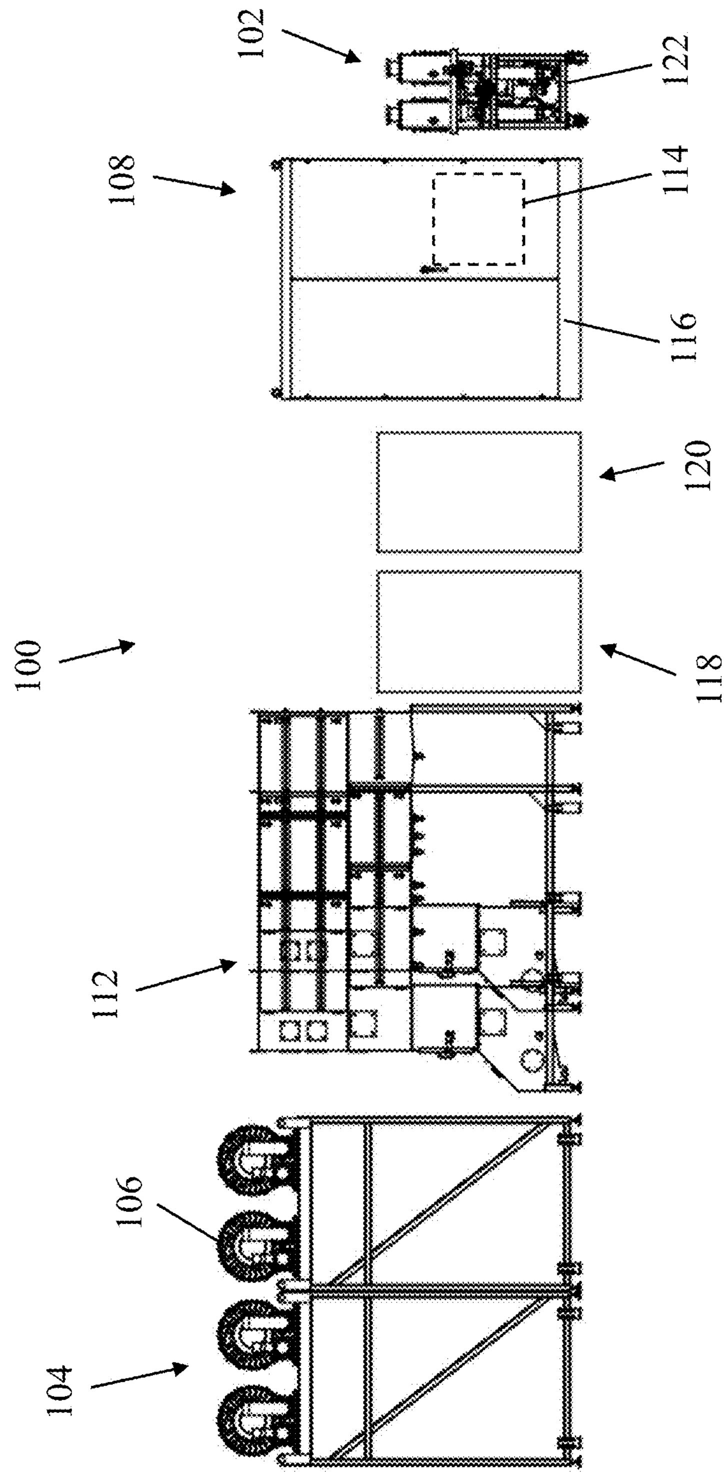


FIG. 2

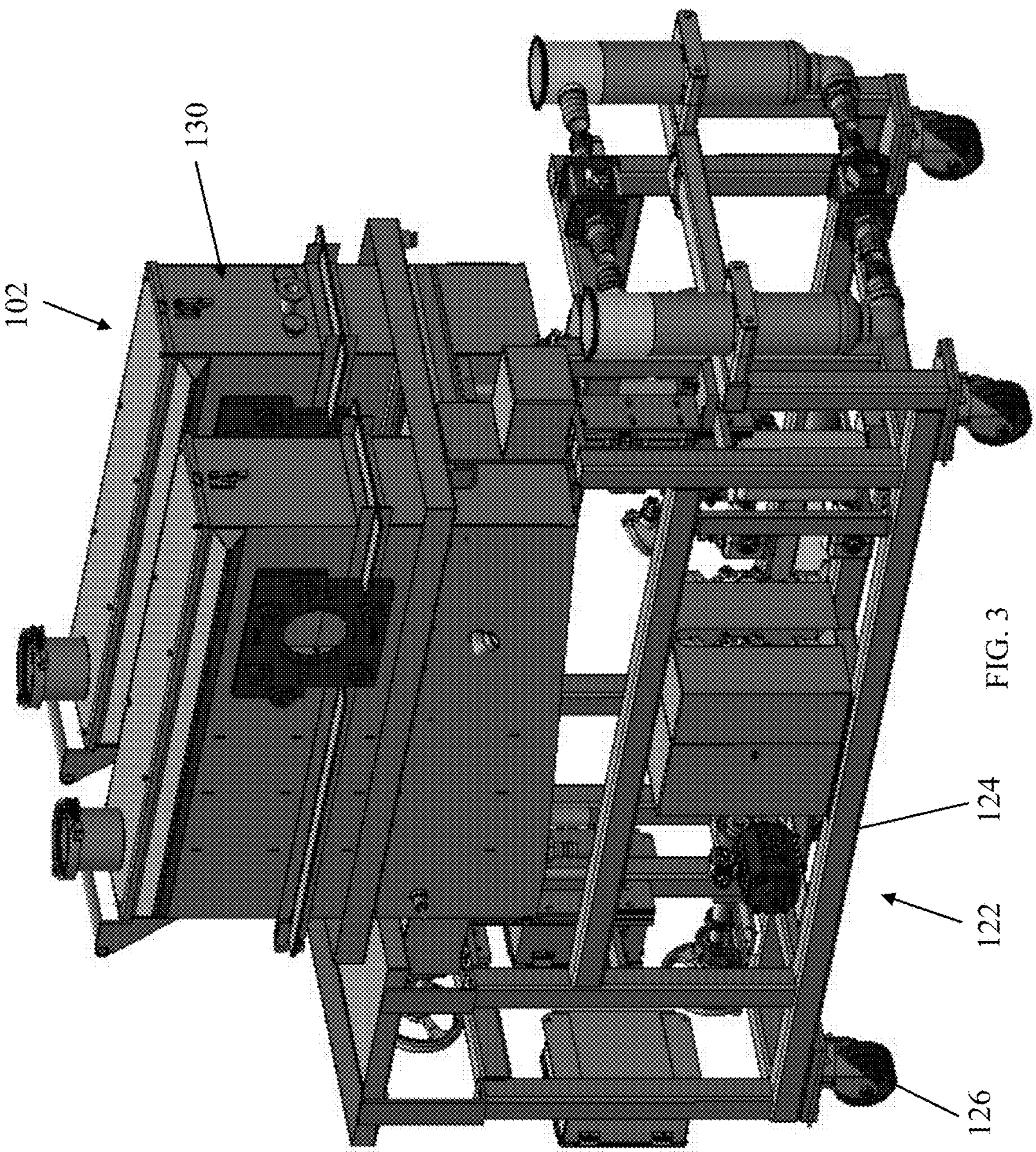


FIG. 3

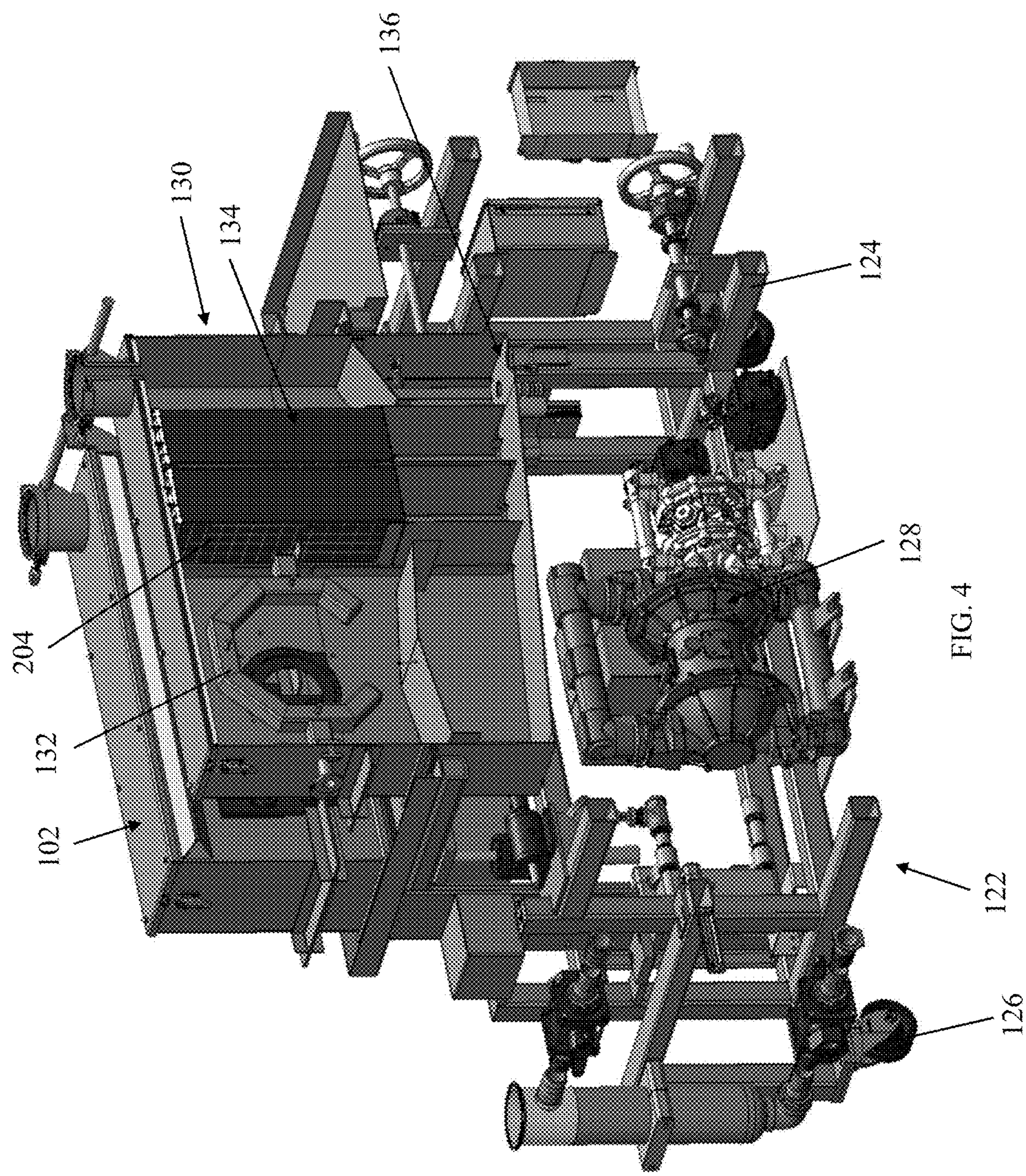
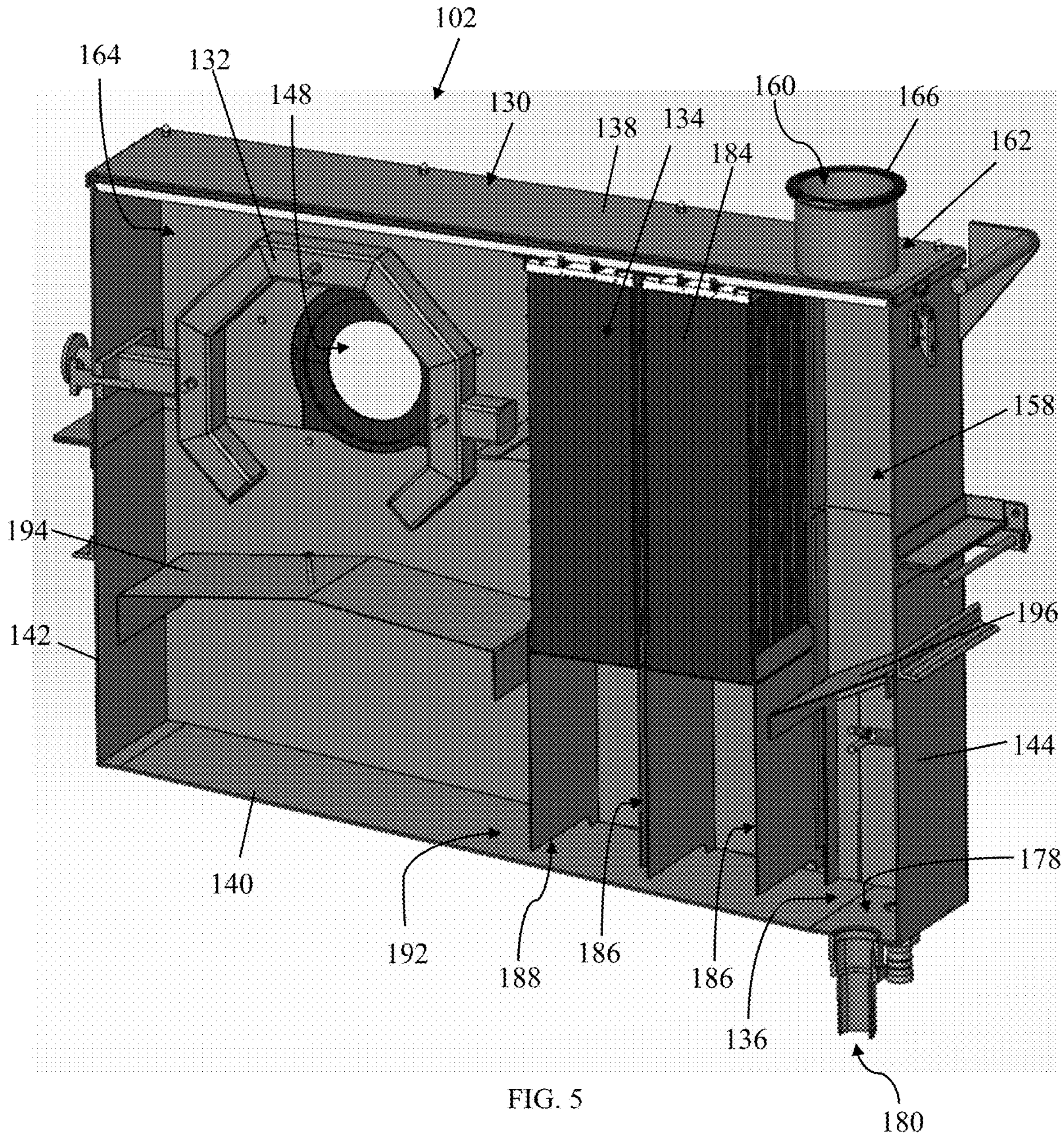


FIG. 4


102
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180

FIG. 5

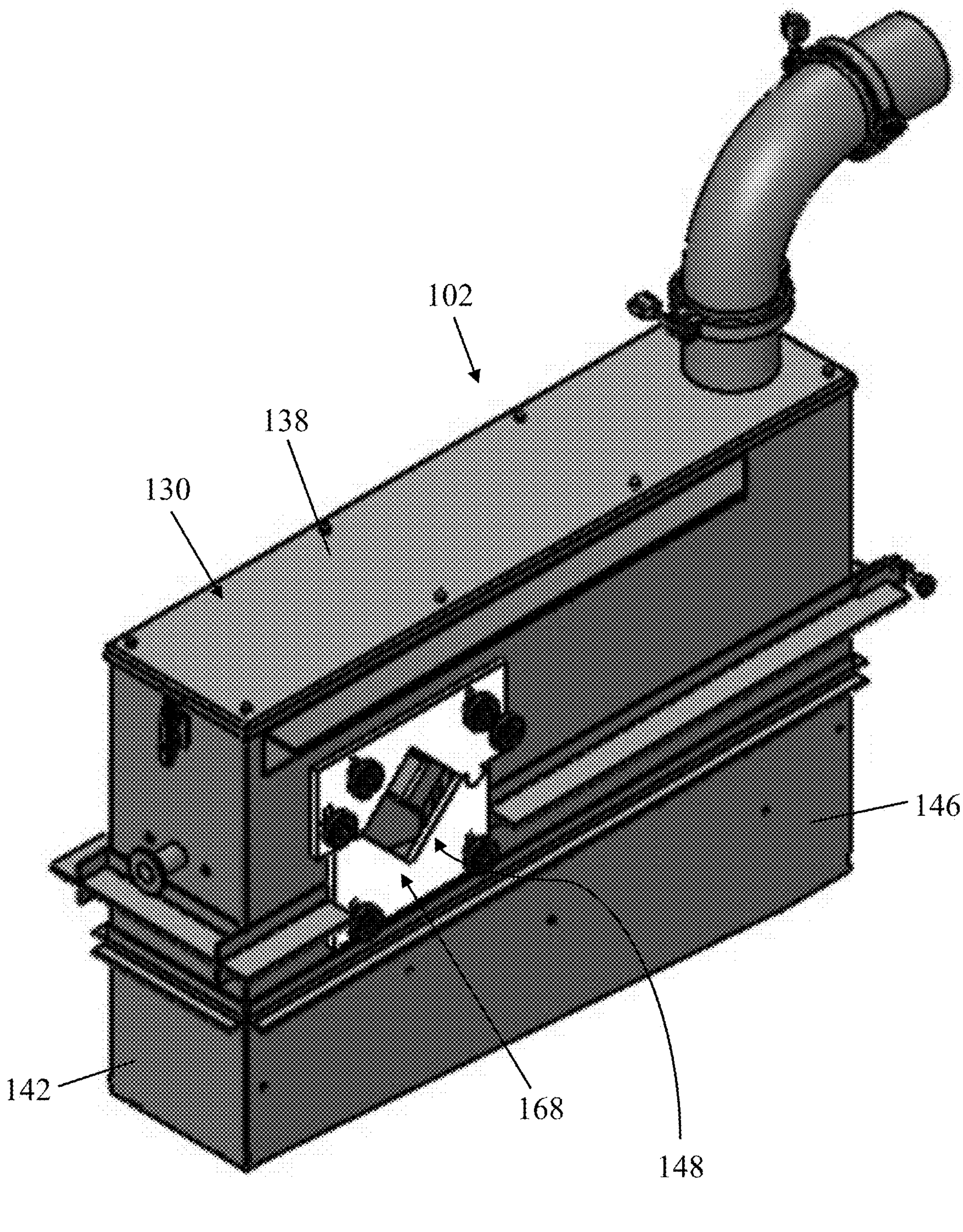

FIG. 6

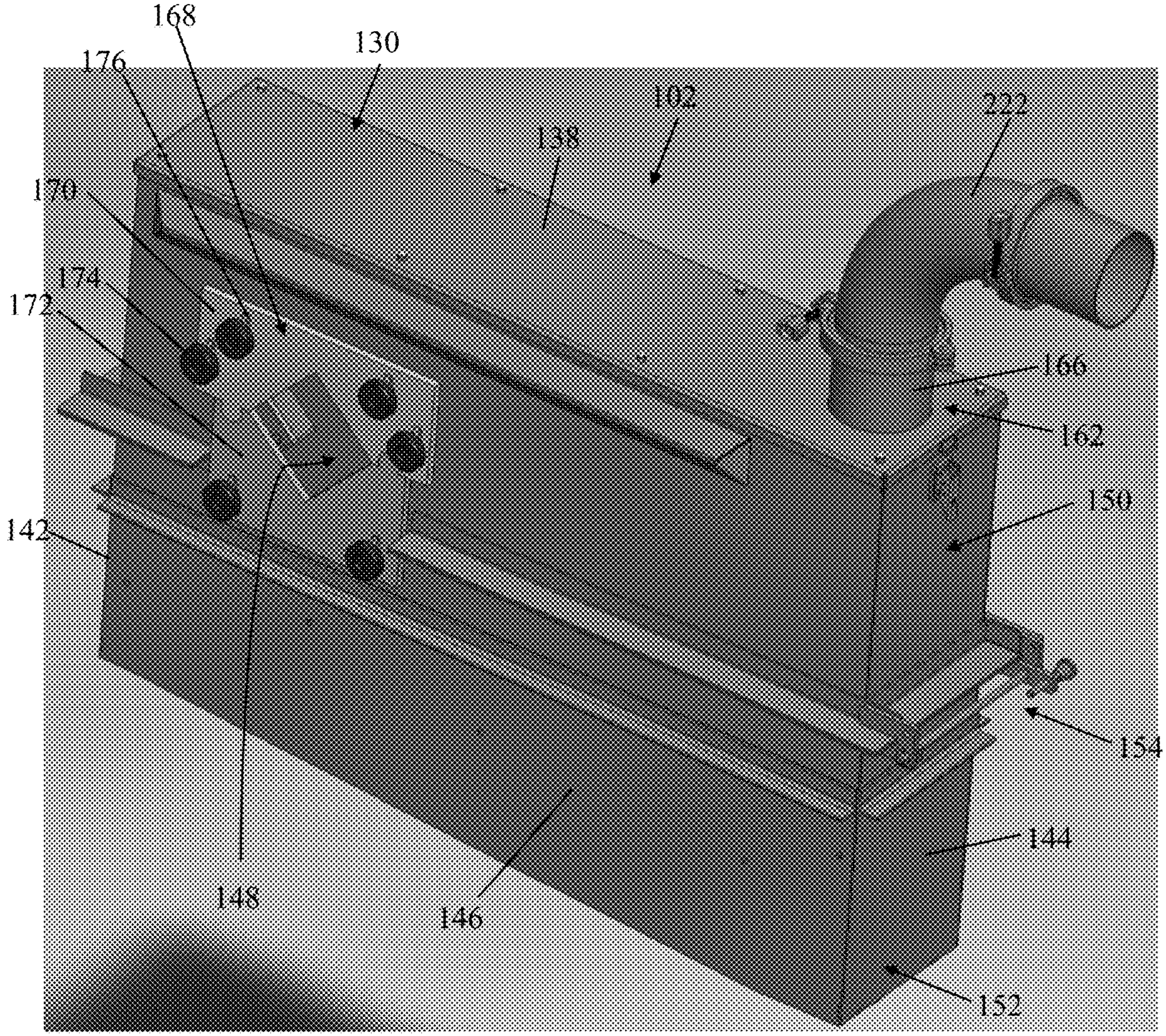
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FIG. 7

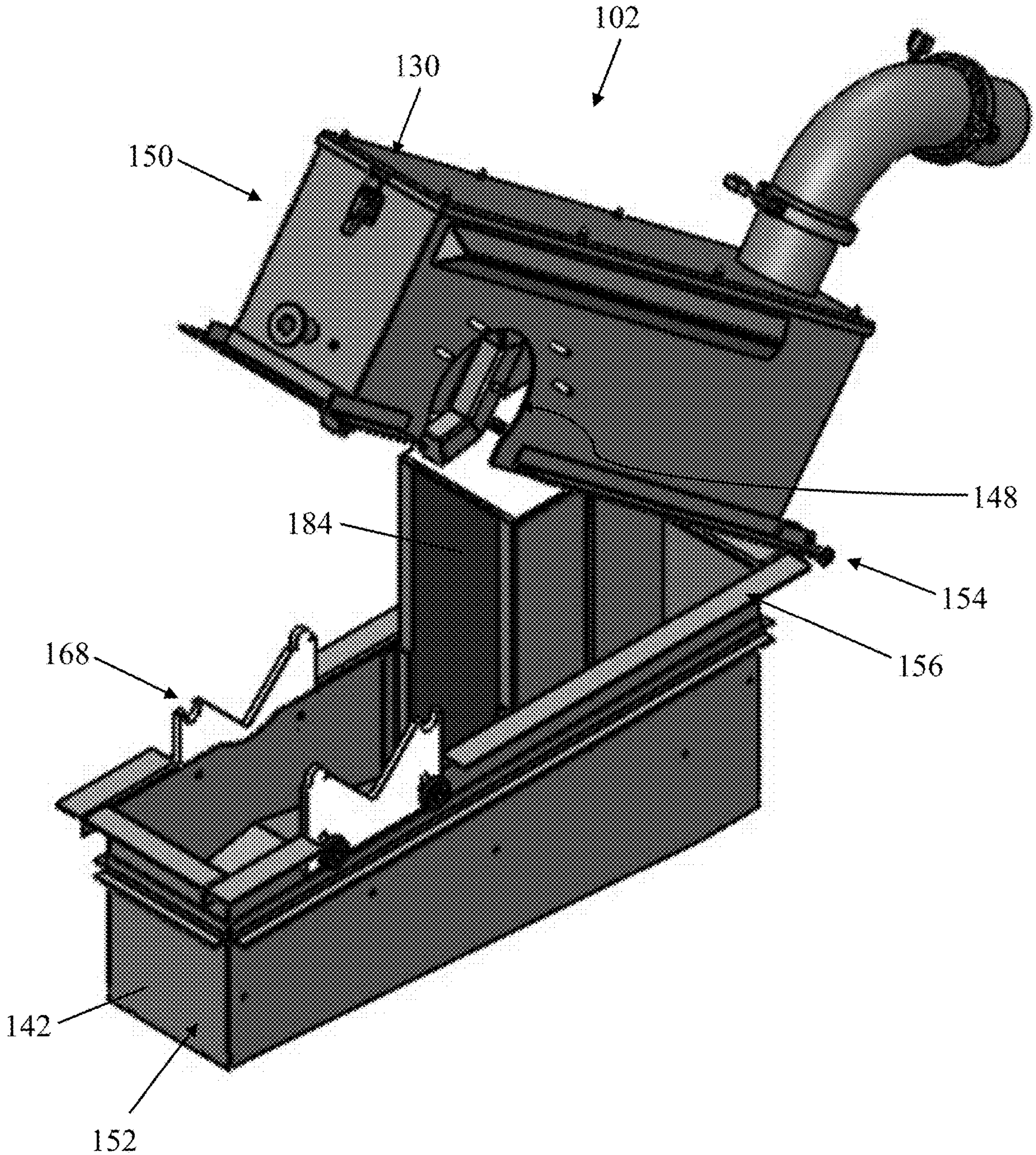

FIG. 8

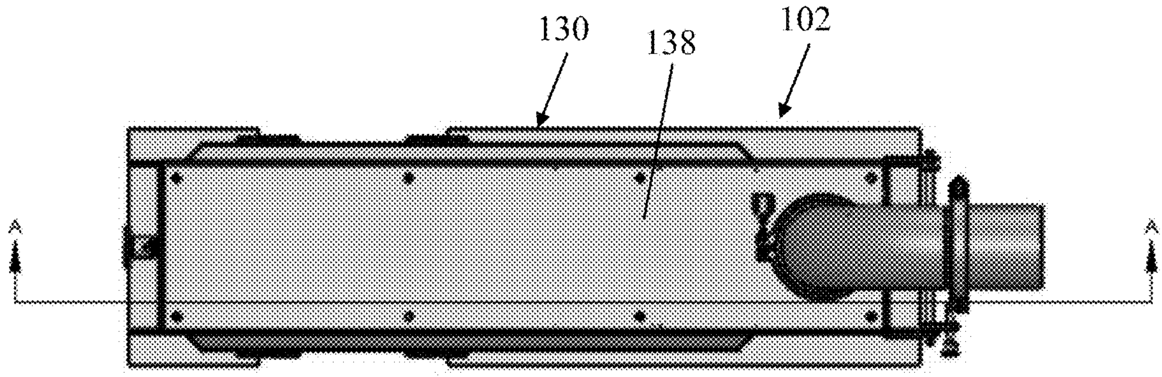
130
138
102
A
A

FIG. 9

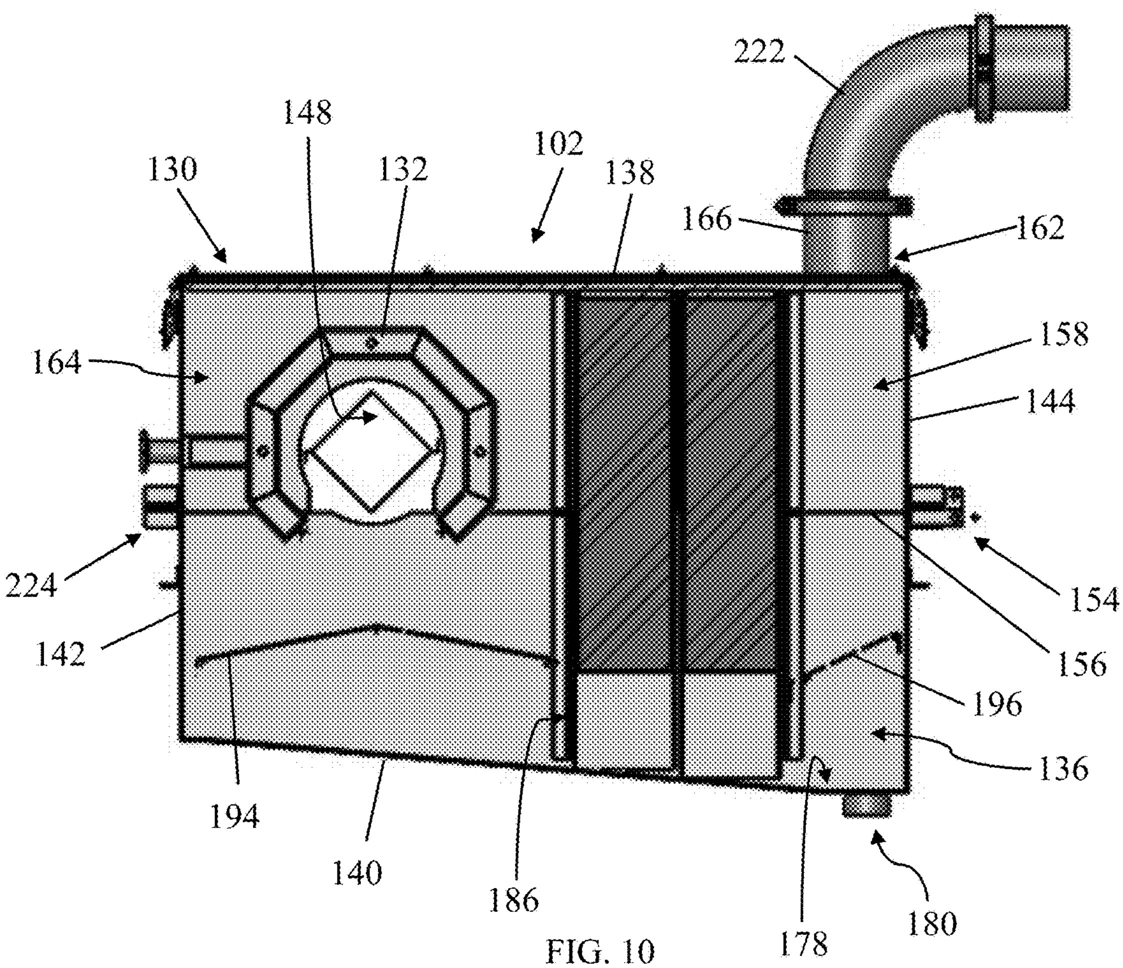
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FIG. 10

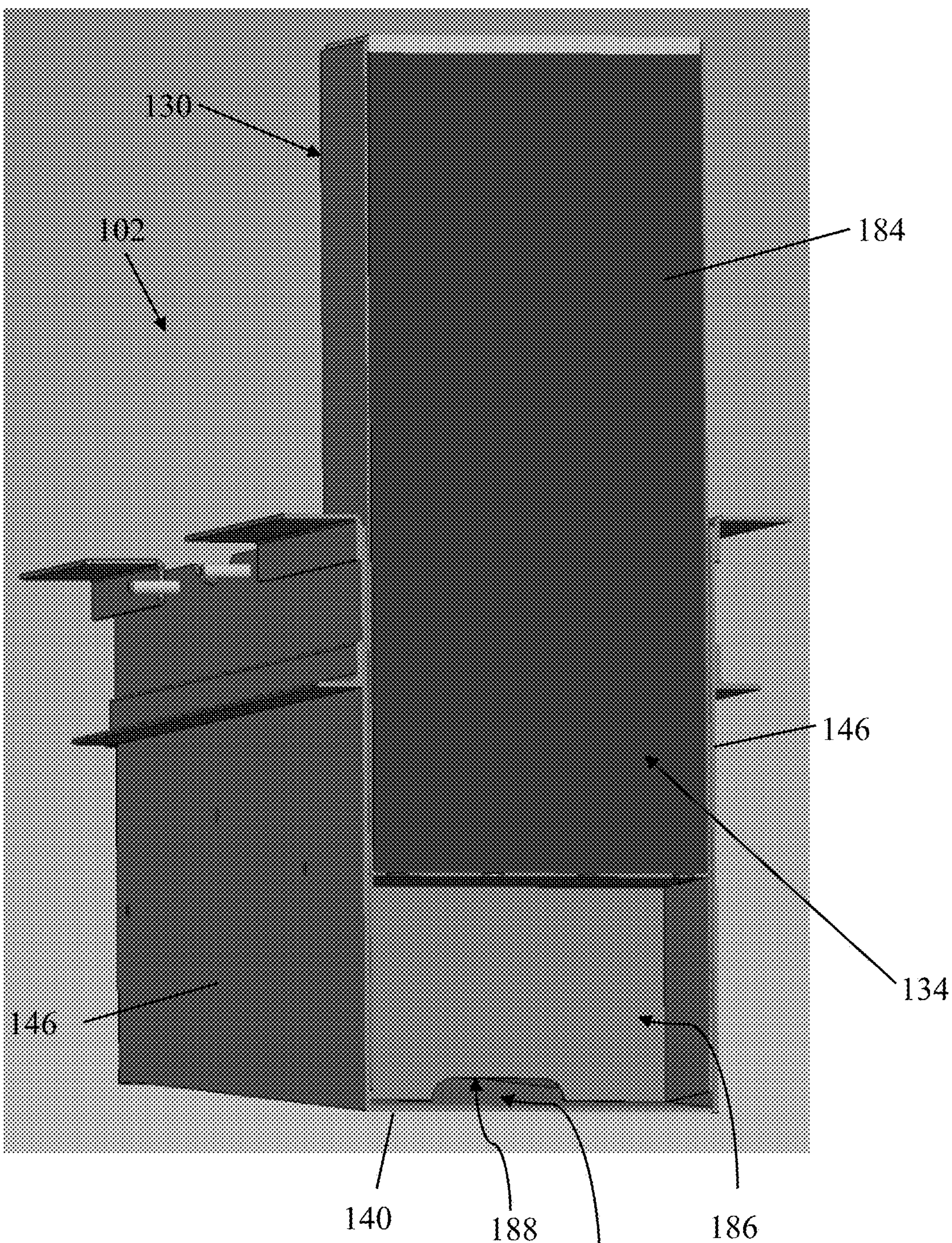

FIG. 11

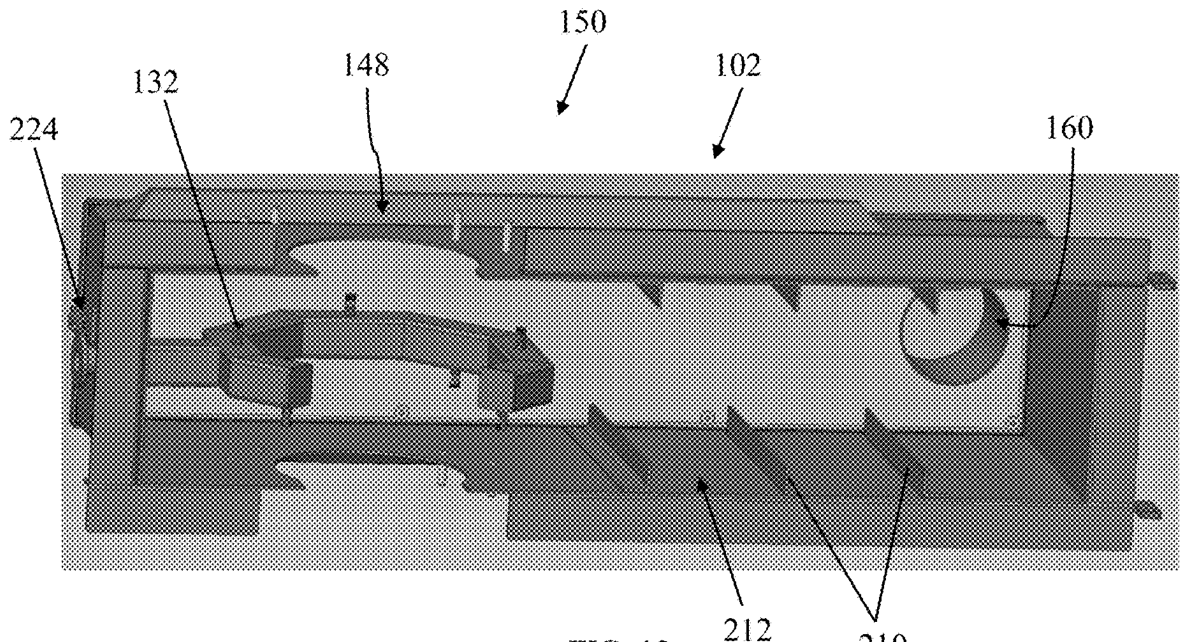

FIG. 12

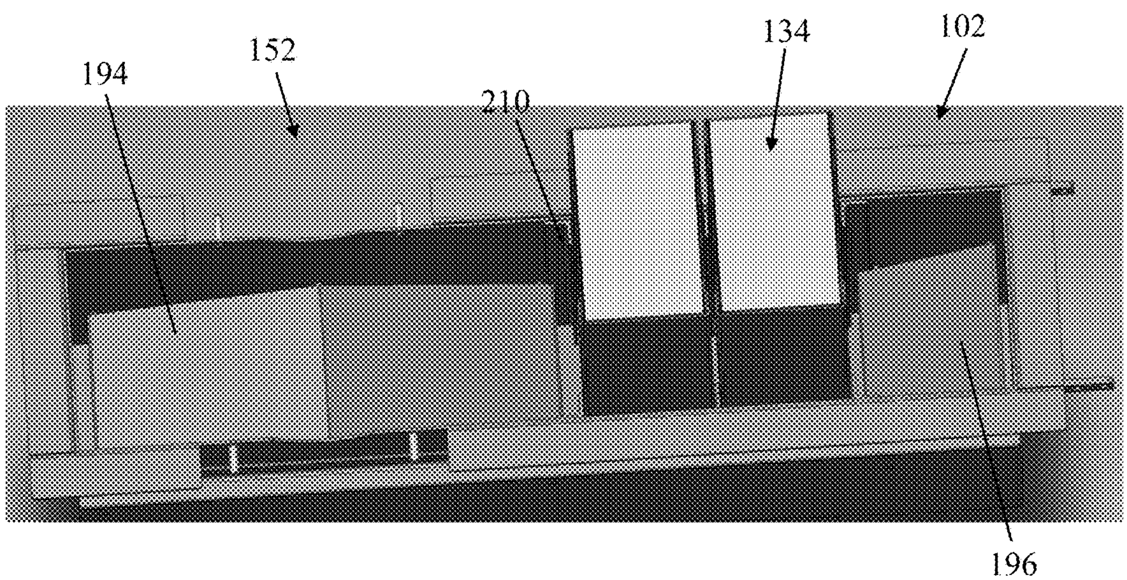

FIG. 13

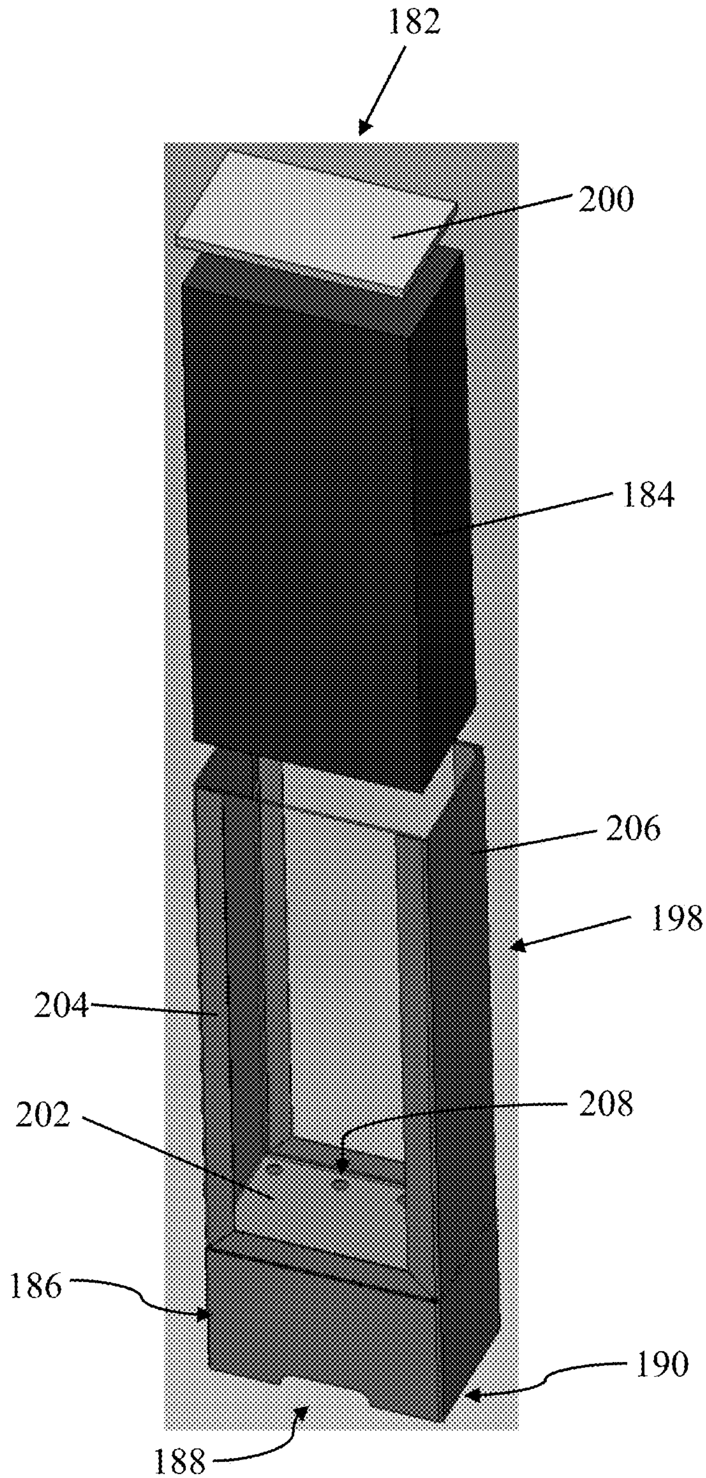

FIG. 14

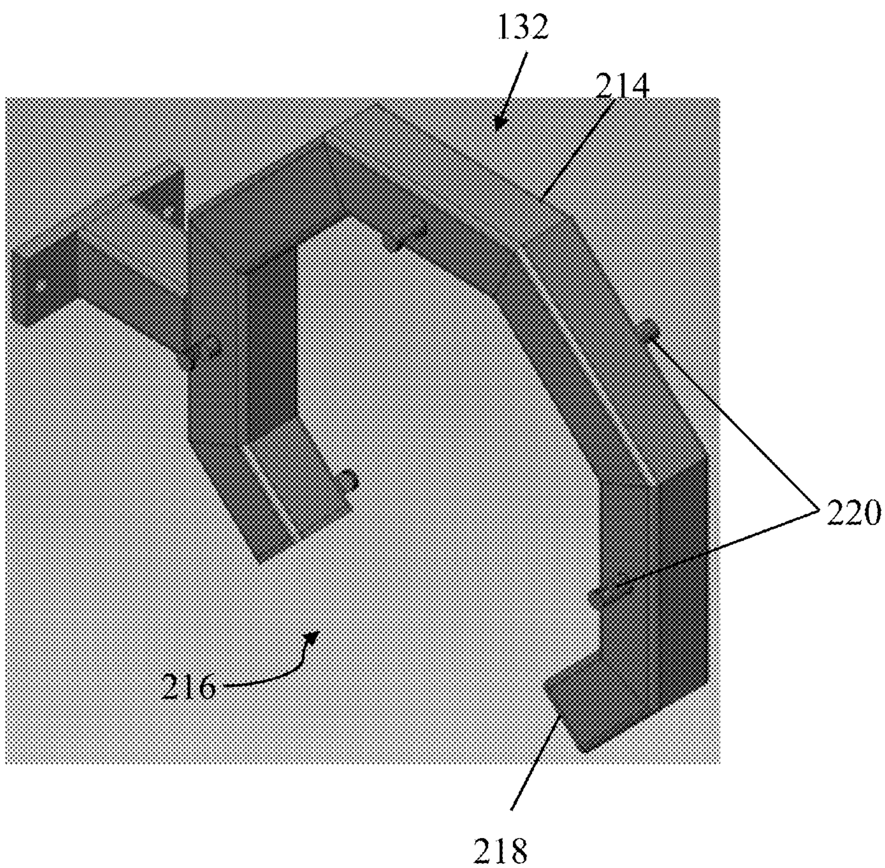

FIG. 15

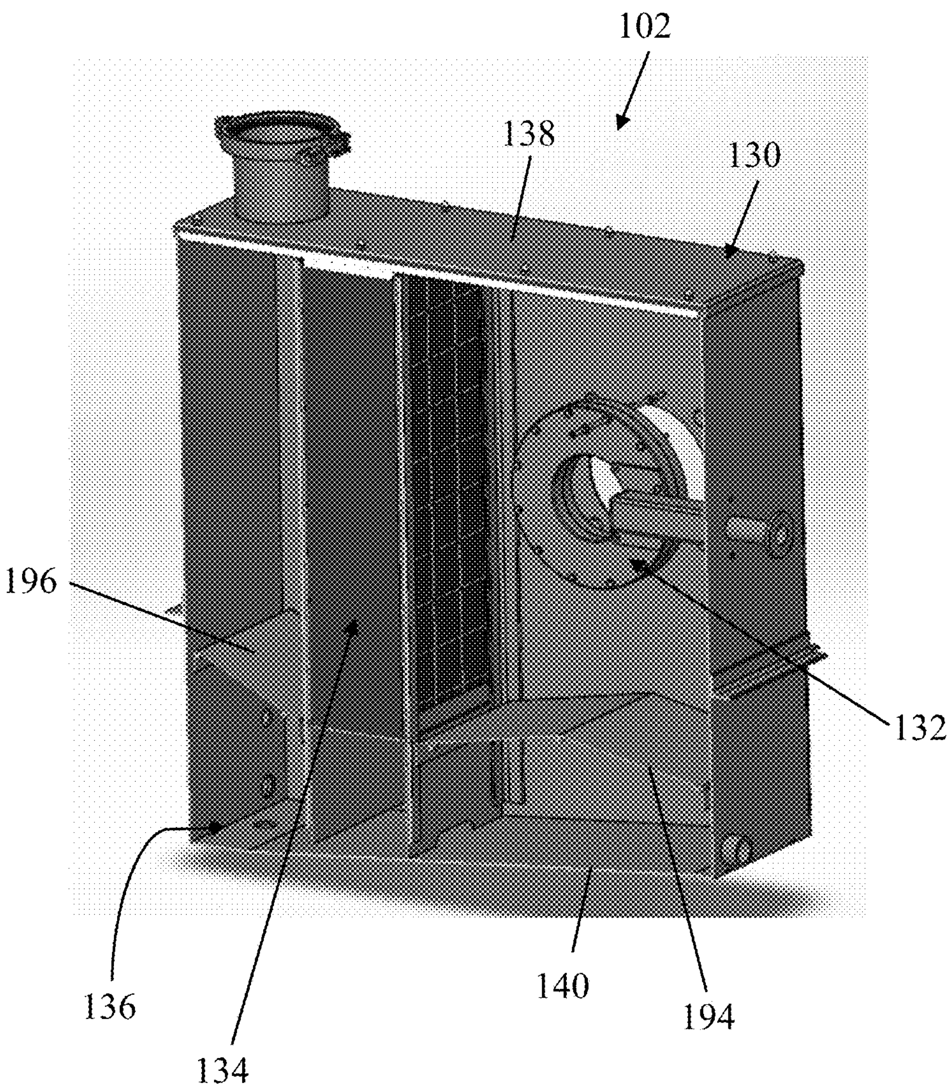

FIG. 16

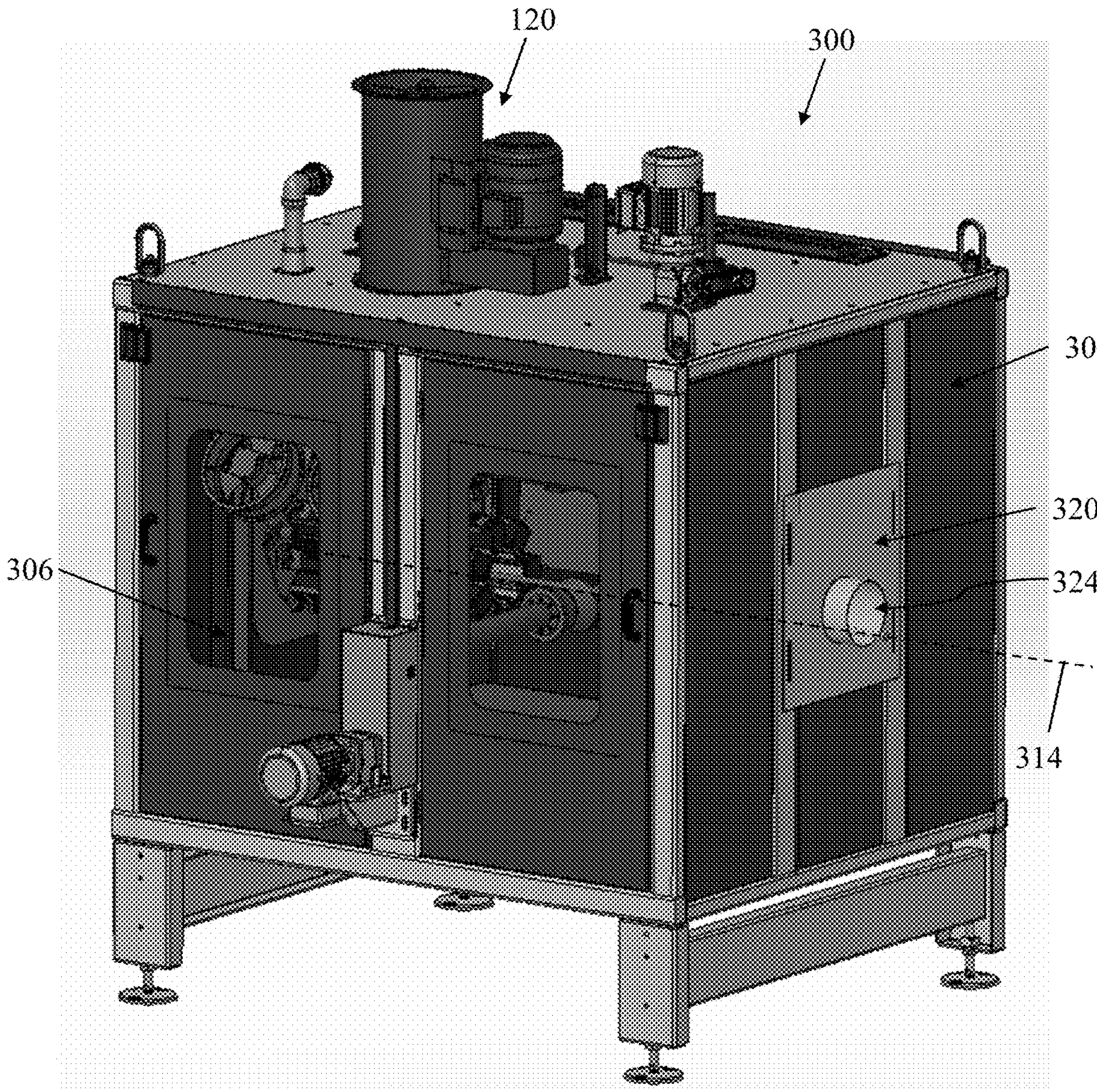

FIG. 17

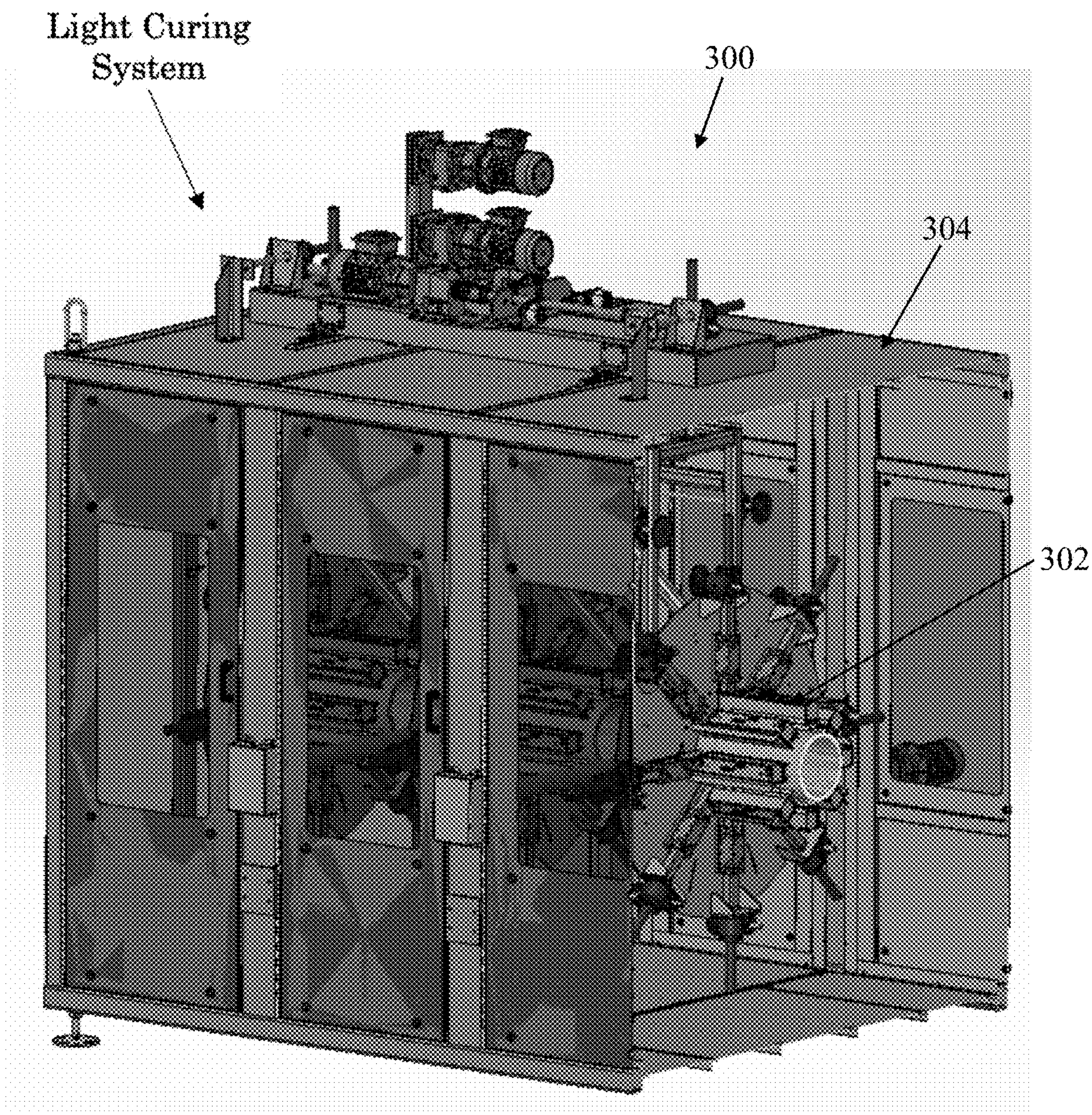

FIG. 18

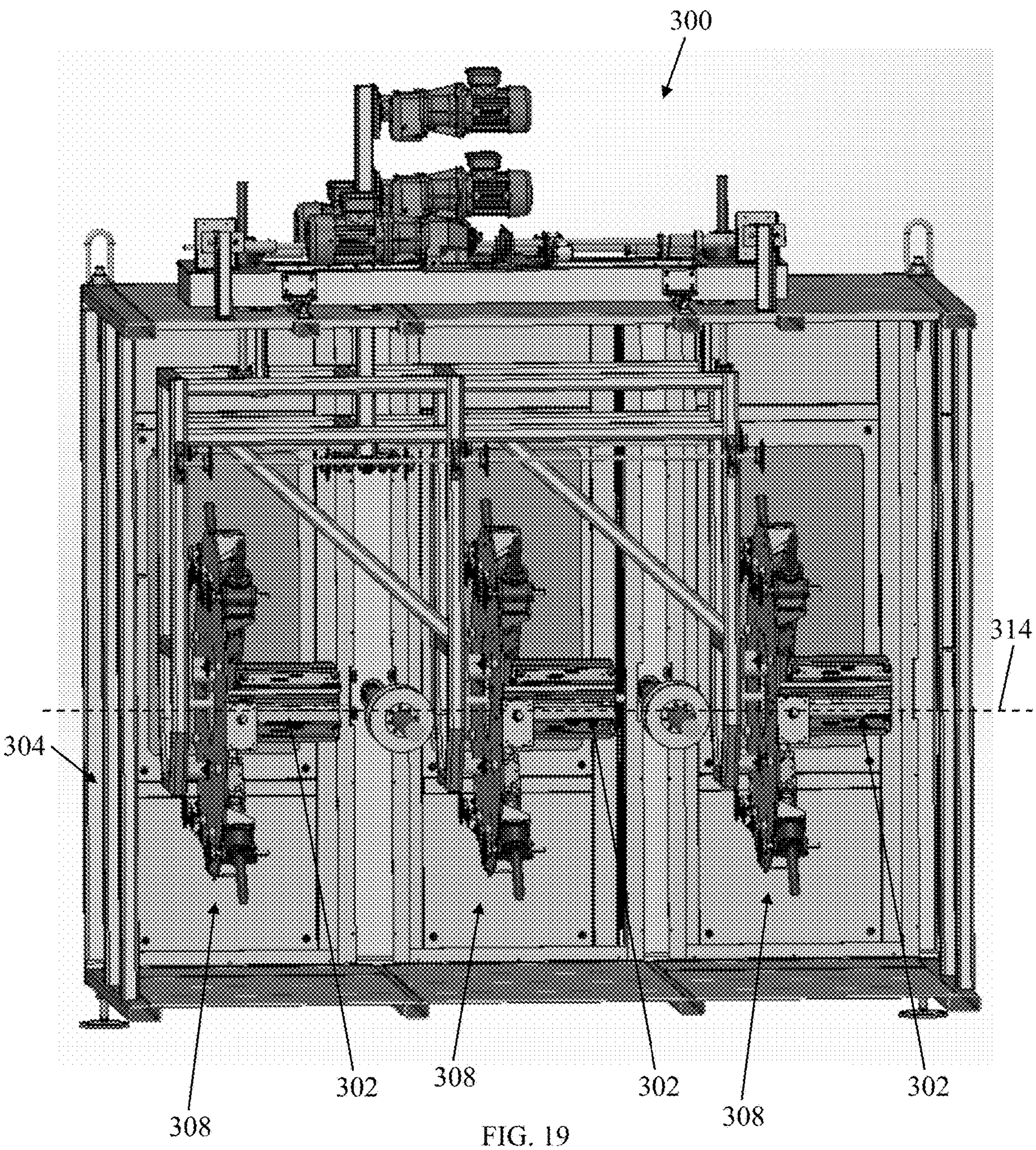

FIG. 19

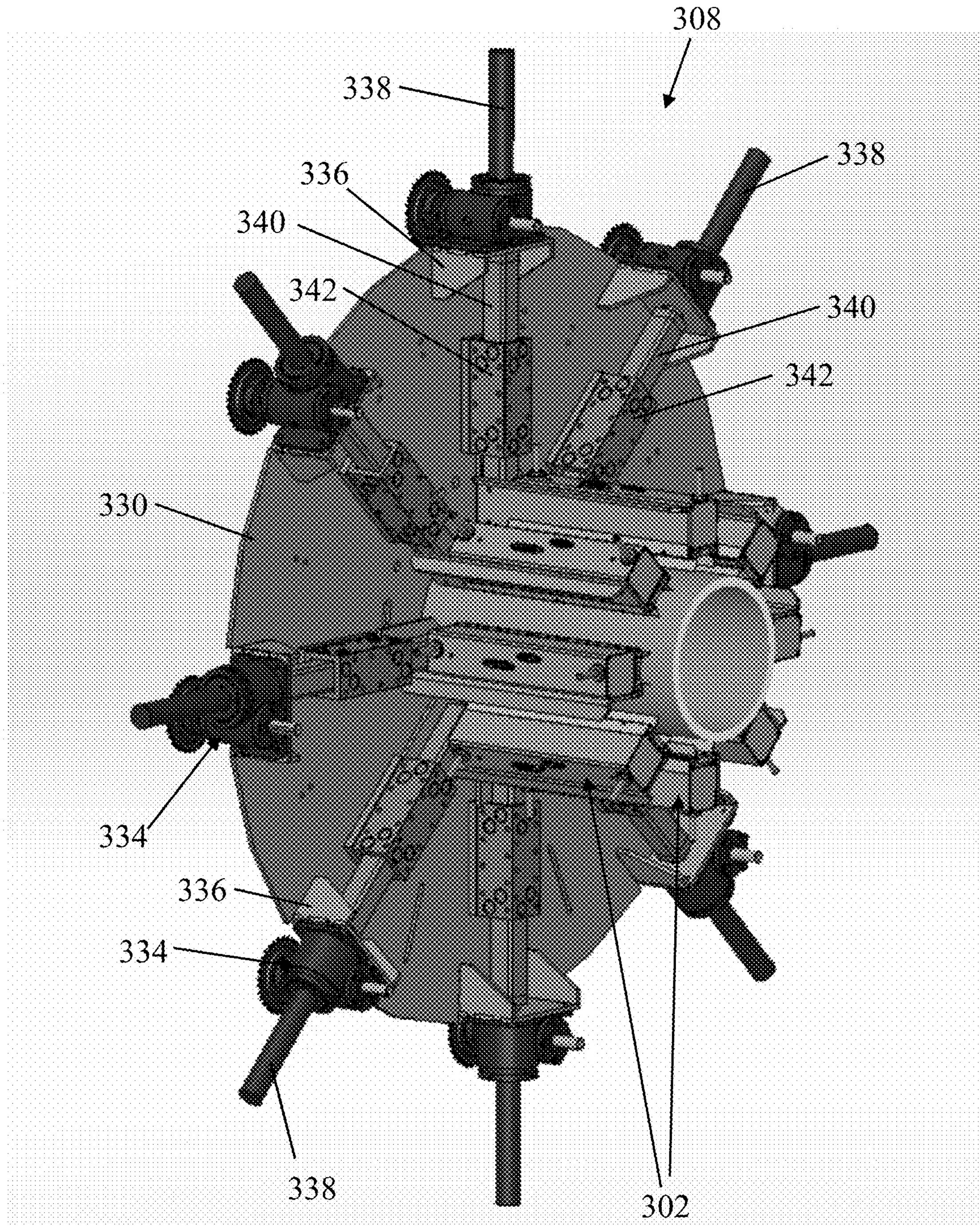

FIG. 20

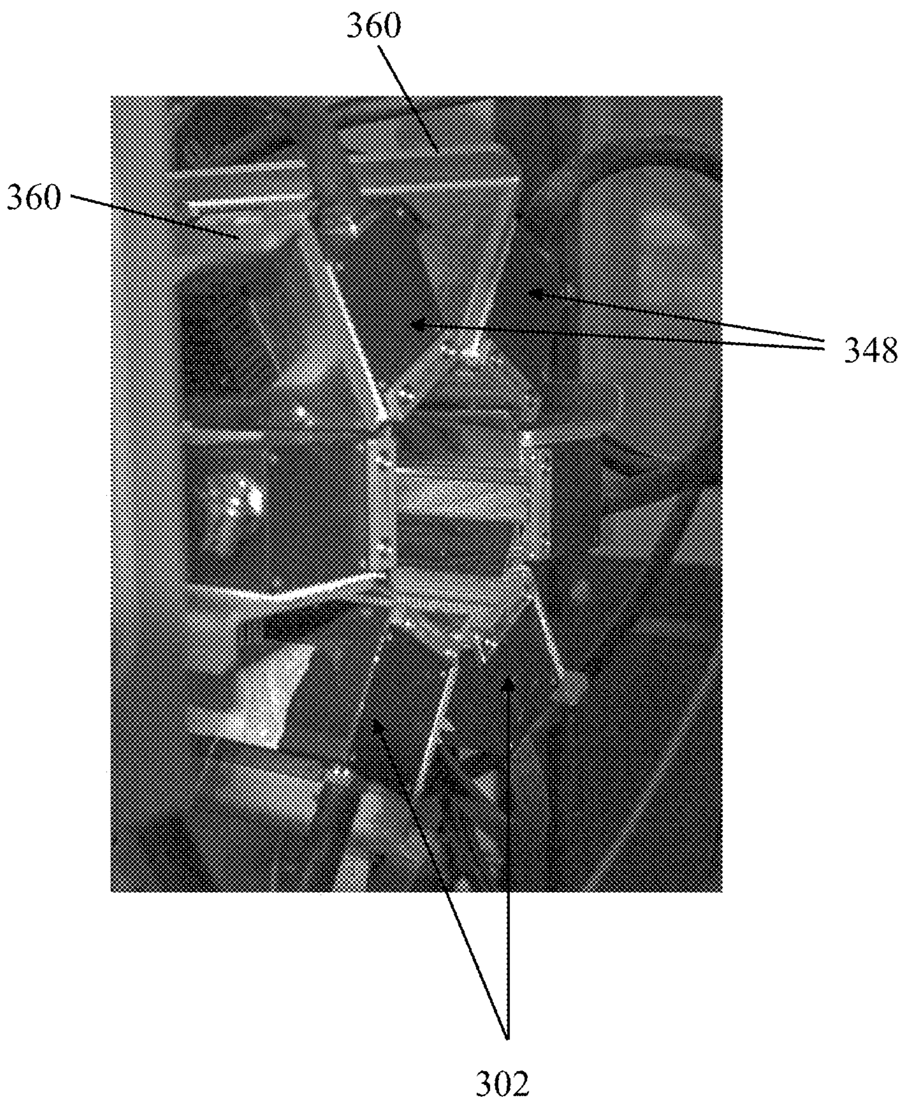

FIG. 21

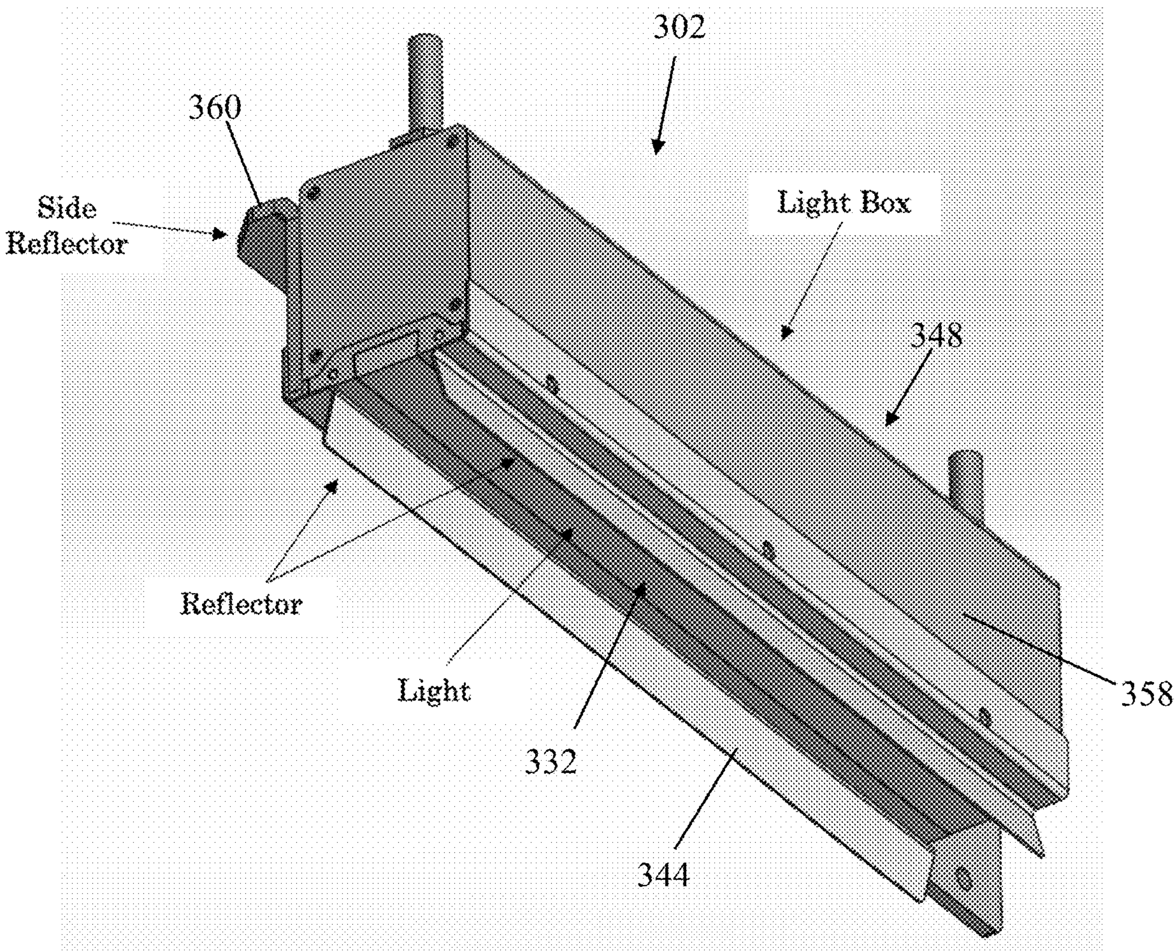
302
360
Side Reflector
Light Box
348
Reflector
Light
332
358
344

FIG. 22

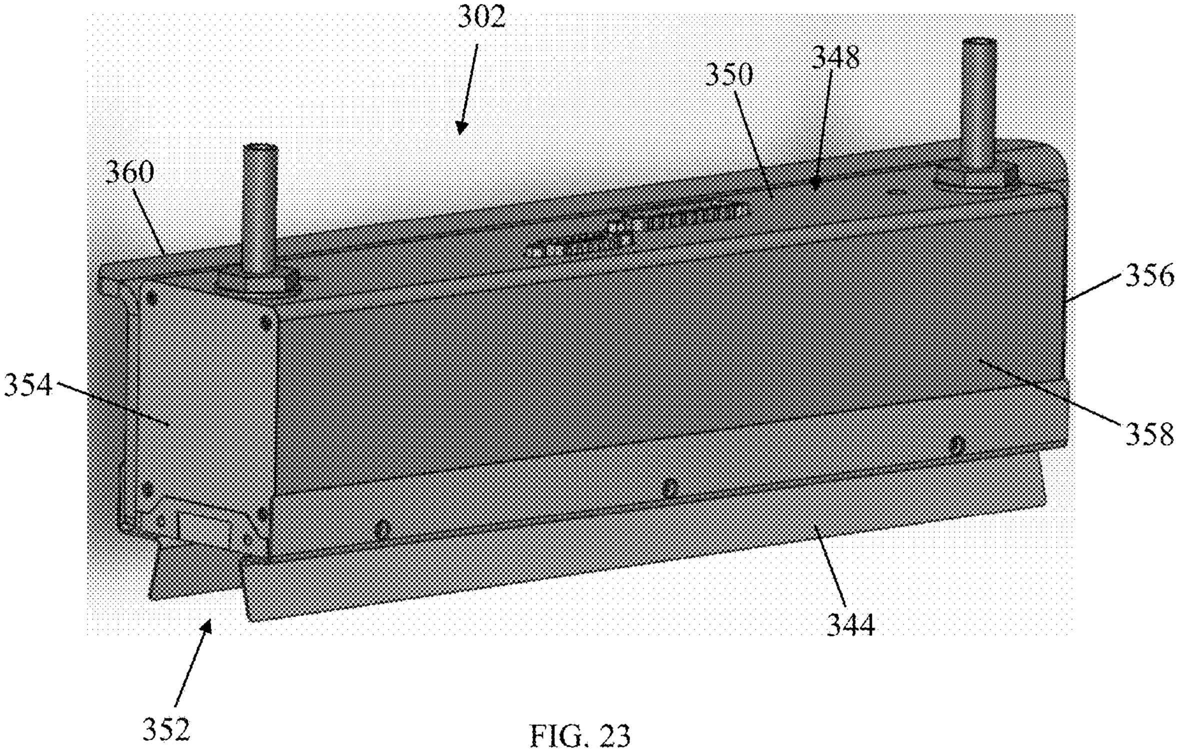
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FIG. 23

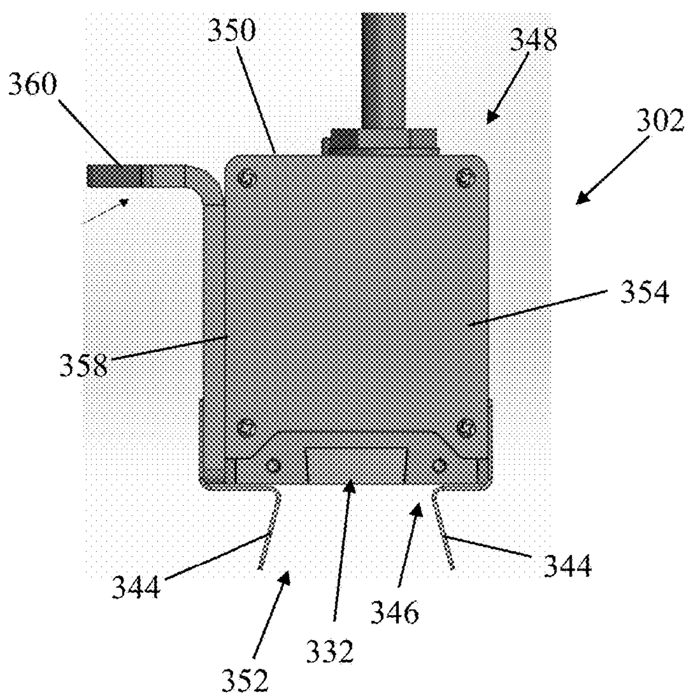
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FIG. 24

VACUUM COATING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and hereby incorporates by reference in its entirety U.S. Provisional Patent Application No. 63/552,675 entitled "VACUUM COATING SYSTEM" filed Feb. 13, 2024.

BACKGROUND OF THE INVENTION

[0003] The present disclosure relates generally to the field of vacuum coating. More specifically, the present disclosure relates to a system for applying a coating and curing a coating applied to a part (i.e., workpiece).

[0004] A vacuum coating process evenly coats a given part by feeding the part through a depressurized or vacuum coating box, within which the coating is applied to the part via one or more spray heads. Excess coating on the part, which may have been unevenly applied onto the part, is suctioned away via the vacuum pressure as the part exits the vacuum coating box. The amount of coating left on the part is generally determined by the vacuum pressure and the feed rate. The air suctioned into and through the vacuum coating box, which is now mixed with the excess coating stripped off the part, is drawn from the vacuum coating box into an external filtration system for filtering out the excess coating from the air suctioned into and through the vacuum coating box. Changing various parameters of the vacuum coating process or performing maintenance on a vacuum coater can be arduous and time consuming. For example, to change the part or coating being applied by the vacuum coater, the operator must typically pause the assembly line and cut or completely remove the part being coated in order to subsequently access the vacuum coater and position the new part in the vacuum coater. To change coatings (e.g., the color of the coating), the operator must pause the assembly line, cut the part being coated from the vacuum coater, and completely clean out the filter and reservoir from the old coating (e.g., previous coating color) before setting up the new coating and new part to be coated.

[0005] Light curing is known in the art to cure various coatings applied to a given part or workpiece. The light "cures" the coating by initiating a photochemical reaction that joins and hardens polymer bonds within the coating. Light curing occurs relatively quickly and thereby can be result in high feed rates to quickly and efficiently cure coatings. However, the light curing process can be energy inefficient and costly to operate. Purchasing different light curing devices to cure different styles and sizes of parts is also exceedingly expensive.

[0006] Accordingly, what is needed is improvements in vacuum coating processes.

SUMMARY OF THE INVENTION

[0007] Aspects of the disclosure provide a dual vacuum coating and curing system. The system includes a vacuum coater that includes a housing, a spray head disposed within the housing and configured to spray a coating onto a part being fed through the housing, and a filtration system disposed within the housing. The system further includes a light curing system located downstream of the vacuum coater and configured to cure the coating on the part.

[0008] In one aspect, a vacuum coater head assembly includes a housing configured to receive a part to be coated with a coating, a spray head disposed within the housing and configured to spray the coating onto the part, and a filtration system disposed within the housing. The filtration system is configured to recover excess coating sprayed by the spray-head.

[0009] In another aspect, a vacuum coating system includes a vacuum coater head assembly configured to receive a part to be coated, spray a coating onto the part, and recover excess sprayed coating. The vacuum coating system further includes a wheeled cart configured to support the vacuum coater head assembly and a pump configured to provide the coating to the vacuum coater head assembly under pressure for spraying the coating onto the part and receive the recovered excess coating from the vacuum coater head assembly, wherein the pump is mounted on the wheeled cart.

[0010] In another aspect, a vacuum coater head assembly includes a housing configured to receive a part to be coated. The housing comprises a pair of opposing sidewalls and a pair of opposing apertures through the pair of opposing sidewalls. The pair of opposing apertures is configured to receive the part to be coated therethrough. The housing further comprises a top section and a bottom section.

[0011] In another aspect, a vacuum coating system includes a vacuum coater head assembly configured to receive a part to be coated and spray a coating onto the part. The vacuum coater head assembly comprises a housing having a top section and a bottom section. The vacuum coating system further includes a wheeled cart configured to support the vacuum coater head assembly and a pump configured to provide the coating to the vacuum coater head assembly under pressure for spraying the coating onto the part, wherein the pump is mounted on the wheeled cart.

[0012] In another aspect, a light curing system includes a light array configured to provide light to a part and cure a coating on the part. The light array includes a plurality of light assemblies. The light curing system further includes a housing that includes an inlet for receiving the part therethrough and an outlet for expelling the part therefrom. The inlet and outlet are coaxial with one another along a longitudinal axis of the light assembly.

[0013] In another aspect, a vacuum coating system includes a vacuum coater head assembly configured to receive a part to be coated, spray a coating onto the part, and recover excess sprayed coating. The vacuum coating system includes a cart configured to support the vacuum coater head assembly and a pump configured to provide the coating to the vacuum coater head assembly under pressure for spraying the coating onto the part and receive the recovered excess coating from the vacuum coater head assembly, wherein the pump is mounted on the cart. The vacuum coating system further includes a light curing system that includes a light array configured to provide light to a part and cure a coating on the part. The light array includes a plurality of light assemblies and a housing. The housing includes an inlet for receiving the part therethrough and an outlet for expelling the part therefrom. The inlet and outlet are coaxial with one another along a longitudinal axis of the light assembly.

[0014] Numerous other objects, advantages and features of the present disclosure will be readily apparent to those of skill in the art upon a review of the following drawings and description of a preferred embodiment.

BRIEF DESCRIPTION OF DRAWINGS

[0015] FIG. **1** is a schematic view of an exemplary embodiment of a vacuum coating system.

[0016] FIG. **2** is a schematic view of another exemplary embodiment of a vacuum coating system.

[0017] FIG. **3** is an elevated perspective view of a wheeled cart of the vacuum coating system of FIG. **1**. The wheeled cart generally includes a vacuum coater head assembly.

[0018] FIG. **4** is a cutaway and elevated perspective view of the wheeled cart of FIG. **3**.

[0019] FIG. **5** is a cutaway and elevated perspective view of the vacuum coater head assembly of FIG. **3**.

[0020] FIG. **6** is an elevated front perspective view of another embodiment of a two-part color head assembly which selectively opens and closes in a clamshell fashion. The color head assembly is shown in its closed, operating position.

[0021] FIG. **7** is an elevated rear perspective view of the color head assembly of FIG. **6**.

[0022] FIG. **8** is an elevated perspective view of the color head assembly of FIG. **6**. The color head assembly is shown in its open position, wherein an operator can easily and efficiently interchange spray heads, switch colors, and clean the color head assembly or perform other maintenance procedures.

[0023] FIG. **9** is a top view of the color head assembly of FIG. **6**.

[0024] FIG. **10** is a cross-sectional view of the color head assembly, taken across line A-A of FIG. **9**.

[0025] FIG. **11** is a cross-sectional and rear end perspective view of the color head assembly of FIG. **6**, illustrating the filtration system.

[0026] FIG. **12** is a bottom perspective view of the top section of the color head assembly of FIG. **6**.

[0027] FIG. **13** is a top perspective view of the bottom section of the color head assembly of FIG. **6**.

[0028] FIG. **14** is a perspective and exploded view of a filter of the vacuum coater head assembly.

[0029] FIG. **15** is an isolation and perspective view of an embodiment of a spray head of the color head assembly of FIG. **6**.

[0030] FIG. **16** is a cross-sectional and perspective view of another embodiment of a vacuum coater head assembly, which includes a single part housing and one filter element.

[0031] FIG. **17** is an elevated front side perspective view of an embodiment of a light curing system of vacuum coating system of FIG. **1**.

[0032] FIG. **18** is an elevated perspective view of an embodiment of a light curing system of the vacuum coating system of FIG. **1**, wherein an end wall of a housing has been removed for ease of reference to the internal components of the light curing system.

[0033] FIG. **19** is another elevated perspective view of the light curing system of FIG. **18**, wherein a sidewall of the housing has been removed for ease of reference to the internal components thereof.

[0034] FIG. **20** is an elevated front perspective view of a light array of the light curing system of FIG. **18**. The light assemblies are positioned in a retracted position, radially further away from the part and the longitudinal axis of the light curing system.

[0035] FIG. **21** is another elevated front perspective view of the light array of the light curing system of FIG. **18**. The light assemblies are positioned in an extended position, radially closer to the part and the longitudinal axis of the light curing system.

[0036] FIG. **22** is a bottom perspective view of a light assembly of the light curing system of FIG. **18**.

[0037] FIG. **23** is an elevated side perspective view of the light assembly of FIG. **22**.

[0038] FIG. **24** is an end view of the light assembly of FIG. **22**.

[0039] Reference will now be made in detail to optional embodiments of the invention, examples of which are illustrated in accompanying drawings. Whenever possible, the same reference numbers are used in the drawing and in the description referring to the same or like parts.

DETAILED DESCRIPTION OF THE INVENTION

[0040] While the making and using of various embodiments of the present disclosure are discussed in detail below, it should be appreciated that the present disclosure provides many applicable inventive concepts that can be embodied in a wide variety of specific contexts. The specific embodiments discussed herein are merely illustrative of specific ways to make and use the invention and do not delimit the scope of the invention. Those of ordinary skill in the art will recognize numerous equivalents to the specific apparatus and methods described herein. Such equivalents are considered to be within the scope of this invention and are covered by the claims.

[0041] To facilitate the understanding of the embodiments described herein, a number of terms are defined below. The terms defined herein have meanings as commonly understood by a person of ordinary skill in the areas relevant to the present disclosure. Terms such as "a," "an," and "the" are not intended to refer to only a singular entity, but rather include the general class of which a specific example may be used for illustration. The terminology herein is used to describe specific embodiments of the invention, but their usage does not delimit the invention, except as set forth in the claims.

[0042] As described herein, an upright position is considered to be the position of apparatus components while in proper operation or in a natural resting position as described herein, for example, as shown in FIG. **3**. Vertical, horizontal, above, below, side, top, bottom and other orientation terms are described with respect to this upright position during operation of the system unless otherwise specified. The term "when" is used to specify orientation for relative positions of components, not as a temporal limitation of the claims or apparatus described and claimed herein unless otherwise specified. The terms "above", "below", "over", and "under" mean "having an elevation or vertical height greater or lesser than" and are not intended to imply that one object or component is directly over or under another object or component.

[0043] The phrase "in one embodiment," as used herein does not necessarily refer to the same embodiment, although it may. Conditional language used herein, such as, among others, "can," "might," "may," "e.g.," and the like, unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain embodiments include, while other embodiments do not include, certain features, elements and/or states. Thus, such conditional language is not generally intended to imply that features, elements and/or states are in any way required for one or more embodiments or that one or more embodiments necessarily include logic for deciding, with or without operator input or prompting, whether these features, elements and/or states are included or are to be performed in any particular embodiment. All measurements should be understood as being modified by the term "about" regardless of whether the word "about" precedes a given measurement.

[0044] All references to singular characteristics or limitations of the present disclosure shall include the corresponding plural characteristic(s) or limitation(s) and vice versa, unless otherwise specified or clearly implied to the contrary by the context in which the reference is made.

[0045] All combinations of method or process steps as used herein can be performed in any order, unless otherwise specified or clearly implied to the contrary by the context in which the referenced combination is made.

[0046] Referring to FIGS. **1-2**, there is shown an exemplary embodiment of a vacuum coating system **100** that is configured to vacuum coat various parts (i.e., workpieces) with one or more coatings via one or more vacuum coater head assemblies **102**, and subsequently cure the coated parts via a light coating system **300**. In an example, a part (unnumbered), such as a long metal pipe, plastic tube, wood plank, or other object, is fed through two vacuum coater head assemblies **102**, at least one of which sprays a coating, such as a UV coating or other liquid coating, such as a water-based paint, onto the part as the part passes through the vacuum coater head assembly **102**. A vacuum system **104** fluidly coupled to the vacuum coater head assemblies **102** generates negative pressure (i.e., a vacuum) within at least one vacuum coater head assembly **102** to suction excess coating off, and/or away from an area surrounding, the part, creating an even and consistent layer of the coating on the part. Disposed downstream of the vacuum coater head assemblies **102** is the light curing system **300** such that immediately after the vacuum coating process is complete, the part is fed through the light curing system **300** for curing the coating on the part. Thereby, the part is vacuum coated and cured in one continuous process flow.

[0047] In one embodiment, referring specifically to FIG. **2**, the vacuum coating system **100** includes a system controller **110**, an external air filter system **112**, and the vacuum system **104** which includes a plurality of blowers **106** fluidly connected to vacuum coater head assemblies **102** and configured to generate negative pressure to draw air from the vacuum coater head assemblies **102**. In one embodiment, the vacuum coating system **100** further includes additional or secondary vacuum coater head assemblies **102**. The secondary vacuum coater head assemblies **102** can be interchanged or positioned in sequence with the primary vacuum coater head assemblies **102**. In one embodiment, the secondary vacuum coater head assemblies **102** have different color or coating types from the primary vacuum coater head assemblies **102**. The system controller **110** includes a hardware processor, a memory, and a human machine interface (HMI) or other user input devices **114** (as shown in phantom in FIG. **2**). The HMI or other user input devices **114** can be located within a control panel **116**. The system controller **110** also includes designated temperature control systems **118**, **120** for controlling the temperature of the vacuum coater head assemblies **102** and the light curing system **300**. A vacuum coater temperature control system **118** is configured to maintain a desired temperature range of the coating, and a light temperature control system **120** (e.g., an LED chiller system) is configured to maintain a desired operating temperature range of the light curing system **300**. The system controller **110** is operably connected to and controls the operations of the vacuum coater head assemblies **102**, the vacuum system **104**, the external air filter system **112**, and the light curing system **300**. The system controller **110** can also include various sensors (not shown), such as temperature and pressure sensors, for sensing the temperature and pressure within a given head assembly **102** (to monitor and control coating thickness on the part).

[0048] FIGS. **3-4** illustrate an embodiment of a wheeled cart **122** of the vacuum coating system **100**, which includes a cart frame **124**, movable by wheels **126** mounted to the cart frame **124**, and one or more vacuum coating head assemblies **102** supported by the cart frame **124** for applying one or more coatings onto the part as the part is fed therethrough. As shown, the cart **122** includes two head assemblies **102** mounted in series with one another for applying two differing coatings in sequence. Alternatively, the downstream head assembly **102** can be configured to not spray a coating, and thus the downstream head assembly **102** will only apply a vacuum or suctioning force to draw sprayed coating off of the part, thinning the layer of coating on the part. The wheeled cart **122** supports the vacuum coater head assemblies **102** thereon and thus allows a user to easily position or remove multiple vacuum coater head assemblies **102** by moving a single, easy to maneuverer structure which enables quickly changing coating colors or types by changing out the wheeled cart **122** (and the vacuum coater head assemblies mounted thereto) for a cart with head assemblies having a different color coating therein.

[0049] One or more fluid pumps **128** (FIG. **4**) are mounted on the cart **122** maintain a desired fluid pressure of the coating(s). The pump **128** is configured to provide the coating to the vacuum coater head assembly **102** under pressure for spraying the coating onto the part and receive the recovered excess coating from the vacuum coater head assembly **102**. In one embodiment, when the wheeled cart **122** includes two head assemblies **102**, the pump(s) **128** also receive(s) the recovered excess coating from the second vacuum coater head assembly **102**.

[0050] Referring to FIGS. **5-15**, in one embodiment, the vacuum coater head assembly **102** includes a housing **130** configured to receive the part to be coated, a spray head **132** disposed within the housing **130** and configured to spray the coating onto the part, an integrated filtration system **134** disposed within the housing **130** and configured to recover excess coating sprayed by the spray head **132**, and a reservoir **136** at a bottom **140** of the housing **130** which is configured to receive the excess coating recovered by the filtration system **134**. Including the filtration system **134** and reservoir **136** within the housing **130** provides a streamlined and more compact vacuum coater head assembly **102** in comparison to prior art vacuum coaters which have a single separate and external filtration system. Also, the head assembly **102** is easy to maneuver as a single unit (by moving an individual housing **130** or cart **122**). Having an all-in-one spray area, filtration system **134**, and reservoir **136** within a single housing **130** reduces the overall working surface area (and eliminates traditional hose lines), making maintenance and cleaning easier. Furthermore, the self-contained head assembly **102** increases the usable life of the coating and reduces waste of the coating because any excess coating is captured by the filtration system **134**, collected in the reservoir **136**, and resupplied via the pump **128** to the spray head **132**. Switching coatings or colors is also faster as the operator need only clean the housing **130**, and interchange spray heads **132** if desired, and accordingly load a new coating into the vacuum coater head assembly **102** in some embodiments of the present invention.

[0051] The housing **130** defines an enclosure including a top **138**, a bottom **140**, a front **142**, a rear **144**, and sidewalls **146** extending between the front **142** and rear **144**. In one embodiment, the top **138** of the housing **130** slopes downward from the rear **144** of the housing **130** toward the front **142** of the housing **130** such that excess coating collecting on the top of the housing **130** drains forward within the housing **130** (and down into the reservoir **136**). The part is fed through opposing apertures **148** respectively disposed within each sidewall **146**. That is, the apertures **148** receive the part therethrough. The apertures **148** are coaxial to and mirror each other (i.e., the apertures **148** are symmetrical such that their spacing from the part is consistent). In one embodiment, one to the apertures may be tighter to the part than the other aperture.

[0052] In one embodiment, the housing **130** is a multibody housing **130**. The housing **130** includes a top section **150** and a bottom section **152** connected to one another via a hinge **154** at the rear **144** of the housing **130**, when the vacuum coater head assembly **102** is assembled. A split or seam **156** between the top section **150** of the housing **130** and the bottom section **152** of the housing **130** passes through the pair of opposing apertures **148**. In other words, the multipart head assembly **102** can be configured as a two-part, clamshell head assembly **102**. The multipart head assembly **102** opens and closes (like a clamshell), articulating in between an open position (FIG. **8**) and a closed position (FIG. **7**). The top section **150** rotates upwardly and downwardly relative to the bottom section **152**. Upon opening the multipart head assembly **102**, the user can easily position or remove the wheeled cart **122** to or from the assembly line, without needing to cut the part. That is, separating the top section **150** from the bottom section **152** allows removal of the cart to be moved away from the part just by slightly lifting the part out of the bottom half of the apertures in the housing **130**. Hence, the operator can open up the clamshell housing **130** and wheel the cart **122** away from the part, allowing the operator to perform maintenance thereon, change the coating or other components, or exchange one vacuum coater head assembly **102** for another vacuum coater head assembly **102** (or differing wheeled cart **122** with vacuum coater head assemblies **102** thereon).

[0053] In one embodiment, the top section **150** of the housing **130** mounts the spray head **132**, and the bottom section **152** of the housing **130** defines the reservoir **136** and mounts the filtration system **134**. The top section **150** can also include the part apertures **148** in its opposed sidewalls **146**. When assembled, the top section **150** receives the top of the filtration system **134**. Hence, the spray head **132** is attached to the top section **150** when the vacuum coater head assembly **102** is assembled. The spray head **132** is open at a bottom of the spray head **132** such that the top section **150** of the housing **130** can be removed and replaced onto the bottom section **152** while the part is received in the housing **130**. The filtration system **134** is supported by the bottom section **152** of the housing **130** when the vacuum coater head assembly **102** is assembled such that when the top section **150** of the housing **130** is separated from the bottom section **152** of the housing **130**, the spray head **132** remains with the top section **150** of the housing **130** and the filtration system **134** remains with the bottom section **152** of the housing **130**.

[0054] The housing **130** further includes an outlet chamber **158**, an air outlet aperture **160**, and a vacuum connection **162** at the air outlet aperture **160** that is configured to connect to the vacuum system **104**. Hence, the vacuum system **104** is configured to draw air from the housing **130** via the vacuum connection **162**. In terms of fluid flow, the vacuum connection **162** is located downstream of the filtration system **134** such that the vacuum system **104** draws air from a spray chamber **164** of the housing **130**, through the filtration system **134**, into the outlet chamber **158**, and out of the housing **130** through the vacuum connection **162**. In one embodiment, the vacuum connection **162** is at a rear **144** of the housing **130**. In one embodiment, the vacuum connection **162** comprises the aperture or opening **160** in the top **138** of the housing **130** and a flange **166**.

[0055] The housing **130** further includes fittings **168** configured to attach to the opposing sidewalls **146** of the housing **130**. The fittings **168** determine a size and shape of the opposing part apertures **148** when the vacuum coater head assembly **102** is coating the part. The opposing apertures **148** are adjustable upon adjusting the fittings **168**. In one embodiment, the fittings **168** include top and bottom plates **170**, **172** connected to the top section **150** and the bottom section **152** by fasteners **174**, respectively (FIG. **7**). In an example, the fasteners **174** include four screwable knobs secured to four threaded protrusions extending from each sidewall of the housing **130**. The bottom knobs may be loosened or completely removed if desired. The top and bottom plates **170**, **172** can slide relative to the housing **130** via slots **176** therein (FIG. **7**), to adjust the size and shape of the apertures **148** to accommodate a given part. The top and bottom plates **170**, **172** can interlock with one another via mating features such as corresponding protrusions and recesses (unnumbered). The split **156** between the top section **150** and the bottom section **152** passes through the fittings **168** such that when the fittings **168** are attached to the opposing sidewalls **146** of the housing **130** and the top section **150** of the housing **130** is separated from the bottom section **152** of the housing **130**, a portion of a fitting **168** (i.e., the top and bottom plates **170**, **172**) remains on each of the top section **150** and the bottom section **152** of the housing **130**.

[0056] The reservoir **136** is integrated into the housing **130** such that a bottom **178** of the reservoir **136** forms the bottom **140** of the housing **130**. The bottom **178** of the reservoir **136** slopes upward from the rear **144** of the housing **130** toward the front **142** of the housing **130** when the vacuum coater head assembly **102** is in an upright position. In other words, because the reservoir **136** is integrated into the housing **130**, a rear portion of the angled bottom wall **140** of the housing **130** defines the bottom **178** of the reservoir **136**. In the configuration of a multipart housing **130**, the reservoir **136** is in the bottom section **152** of the housing **130**. A fluid exit port or outlet **180** disposed at the bottom **178** of the reservoir **136** allows the excess coating to exit the housing **130** and be recirculated via the pumps **128** through the vacuum coating system **100**, reducing waste.

[0057] The filtration system **134** is fluidly coupled in between the spray chamber **164** and the vacuum connection **162** (i.e., airflow outlet of the housing **130**). The filtration system **134** is completely disposed and housed inside of the housing **130** and is located above the reservoir **136**. The filtration system **134** is configured to capture and collect the excess coating which is suspended in the air, and thereafter drain the collected coating down into the reservoir **136**.

[0058] The filtration system **134** includes a filter assembly **182** including at least one filter element **184** and a plurality of baffles **186** configured to collect excess coating thereon and drain the excess coating to the reservoir **136**. The filter element **184** configured is to separate excess coating from air flowing through the housing **130** and drain the separated excess coating toward the bottom **140** of the housing **130** (into the reservoir **136**). The filtration system **134** further includes a support baffle **186** configured to contact the filter element **184**. The filter element **184** and the support baffle **186** cooperate to extend between opposing sidewalls **146** of the housing **130** and the top **138** of the housing **130** such that air drawn through the housing **130** cannot flow between the filter element **184** or the support baffle **186** and the opposing sidewalls **146** of the housing **130** or the top **138** of the housing **130**. The support baffle **186** is angled downward from the rear **144** of the housing **130** and extends between the opposing sidewalls **146** of the housing **130**. The support baffle **186** includes an aperture **188** at a bottom **190** (FIG. **14**) of the support baffle **186** (next to the bottom **140** of the housing **130**) such that excess coating can flow along the bottom **140** of the housing **130** under the support baffle **186** and filter element **184** to the reservoir **136**. In other words, the support baffle **186** raises the filter element **184** above the bottom **140** of the housing **130** at a set distance and thus creates a fluid passageway **192** underneath the filter element **184**, fluidly connecting the spray chamber **164** to the reservoir **136** via the aperture(s) **188**. In one embodiment, the support baffle **186** is comprised of one or more support walls. In one embodiment, the support baffle **186** further includes a separate top plate, with fluid apertures therein, that is connected to the sidewalls of the housing **130** and/or to the support walls.

[0059] The filtration system **134** further includes one or more deflector baffles **194**, **196** disposed within and connected to the housing **130**. In one embodiment, the filtration system **134** includes a front, spray chamber deflector baffle **194** (or divider plate) and a rear, reservoir deflector baffle **196** (or divider plate). The spray chamber deflector baffle **194** comprises a bent plate with an apex and front and rear ends (unnumbered). The spray chamber deflector baffle is spaced apart at a distance (or gap) from the front of the housing **130** at its front end and the filter element **184** at its rear end. The spray chamber deflector baffle **194** receives and guides excess coating toward the bottom **140** of the housing **130**. The reservoir deflector baffle **196** is located within the air outlet chamber **160** of the housing **130**, above the reservoir **136**. The reservoir deflector baffle **196** extends forward from a rear **144** of the housing **130** above the reservoir **136**. The reservoir deflector baffle **196** comprises an angled plate that is spaced apart from the rear **144** of the housing **130** at its rear and the filter element **184** at its front end. The reservoir deflector baffle **196** is at least partially separated from the support baffle **186** such that air drawn through the housing **130** can pass between the support baffle and the reservoir deflector baffle **196**. Additionally, the spray chamber deflector baffle **194** is also at least partially separated from the support baffle **186** such that air drawn through the housing **130** can pass between the support baffle **186** and the spray chamber deflector baffle **194**.

[0060] In one embodiment, as shown in FIG. **14**, the filtration system **134** includes two filter elements **184**. Each filter element **184** is disposed within a respective filter housing **198** (each composed at least in part by a respective support baffle **186**). Each filter housing **198** can be comprised of rails, panels, meshed walls, and/or ridges or protrusions extending inwardly from the sidewalls of the housing **130**. In one embodiment, the filter housing **198** can include a top plate **200**, a bottom plate **202**, a front and a rear mesh screen or wall **204**, and sidewalls **206**. The bottom plate **202** includes fluid apertures **208** (i.e., drain holes) that allow excess coating collected by the filter element **184** to drain downwardly through the fluid apertures **208** onto the bottom **140** of the housing **130** (and through the fluid passageway **192** and into the fluid reservoir **136**). Furthermore, the filter housing **198** can include mounting or locating features **210**, such as inwardly protruding rails, that locate and seat the filter housings **198** within the housing **130**. The locating features **210** can be mounted to the top section **150** and/or the bottom section **152** of the housing **130**. The locating features define filter bays **212** for receiving the filter housings **198** therein (FIG. **12**). The locating features **210** can be in the form of ridges or rails or bent plates welded to the interior of the housing **130**. The filter element **184** can be in the form of any desired filter, such as a ceramic filter, carbon filter, cloth filter, etc.

[0061] Referring specifically to FIG. **15**, in one embodiment, the spray head **132** includes an annular body **214** (i.e., at least partially annular), with a bottom open end or gap **216** between distal ends **218** thereof, and multiple outlets **220**, e.g., spray nozzles, disposed about the body **214**. The spray head **132** can be in the form of any desired spray head **132**. As shown, the spray head **132** is a partial ring or circular spray head. However, the spray head can be in the form of a full ring or circle, a semi-circular spray head, a rectangular spray head, a bar-like spray head, etc. As can be appreciated, the clamshell housing **130** allows the operator to easily interchange spray heads **132** as desired. In one embodiment, if the spray head **132** fully encircles the part, then the spray head is formed of two parts, one attached to the top section of the housing **130**, and one to the bottom section of the housing **130**.

[0062] Referring specifically to FIG. **16**, in an alternative embodiment, the housing **130** is a monolithic (i.e., single body) housing **130**. The top **138** of the housing **130** can be removable to access the interior of the housing **130**. In an example, the top **138** of the housing **130** can be removably fastened to the sidewalls of the housing **130** via fasteners, such as screws, bolts, and/or clamps. The single body vacuum coater head assembly **102** includes one filter element **184**. Like elements have been identified with like reference characters.

[0063] In operation, the part is fed into the inlet part aperture **148** in the housing **130**. The spray head **132** applies the coating onto the part. The vacuum within the housing **130**, created by the vacuum blowers **106**, draws air and the excess fluid coating out of the spray chamber **164** of the housing **130**. Excess coating is suctioned off from the part and becomes suspended in the air within the spray chamber **164**. The air and suspended fluid coating (e.g., aerosol particulate matter) is drawn from the spray chamber **164** into the filtration system **134**. The filtration system **134** captures the suspended coating particles and thereafter directs the collected excess coating to the reservoir **136**. Since the filtration system **134** is integrated into the housing **130**, the forward wall of the filtration system **134** defines the end wall of the spray chamber **164**. Thereby, the air and excess coating suspended therein are drawn out of the spray chamber **164** and directly (and only) into the filtration system **134**. Excess coating (e.g., in fluid form not suspended in air) may also fall downwardly to the bottom **140** of the housing **130**, due to gravitational forces. As the excess coating falls downwardly toward the bottom **140** of the housing **130**, the excess coating will contact the spray chamber deflector baffle **194** disposed within the housing **130**. The excess coating will fall through gaps at the front and rear ends of the spray chamber deflector baffle **194**, and down onto the bottom wall of the housing **130**. The downward slope of the angled bottom wall **140** of the housing **130** guides the excess coating thereon toward the reservoir **136**. After passing through the filtration system **134**, the air will be cleaned, enter the air outlet chamber at the rear **144** of the housing **130**, and thereafter be pulled out of the air outlet **160** of the vacuum connection **162** of the housing **130** via the vacuum system **104**.

[0064] To change coatings or colors within the vacuum coater head assembly **102**, the operator can perform the following exemplary method. Initially, the cart **122** can be located within the line assembly. The operator can indicate a desired machine shut down or pause cycle on the HMI **114**. The spray head(s) **132** (respectively disposed within corresponding head assemblies **102**) can finish the last received command and accordingly cease operation. For example, if equipped with two head assemblies **102** on a single wheeled cart **122**, the system controller **110** will stop coating the part in the first head assembly **102** and allow the second head assembly **102** to finish applying its coating onto the part as the part is further fed therethrough. Air can be stopped in the first head assembly **102** and further drawn out of the second head assembly **102**, which evens the layers of coating on the part. Then, once the second head assembly **102** is finished applying its coating and drawing out air, the spray head **132** can be shut down and the vacuum blowers may stop suctioning out air. When the line is stopped, the operator can begin opening up the multipart head assembly **102**. The operator can initially remove and/or loosen the one or more fittings **168** surrounding the part apertures **148**. The operator can decouple the air hose **222** connected to the vacuum connection **162** of the housing **130**. Thereafter, the operator can unlatch a front latching mechanism **224** and hinge the top section **150** of the housing **130** upwardly. Optionally, the operator can remove the spray head **132** before or after opening the two-part housing **130**. The operator can repeat these steps for each head assembly **102** mounted on the respective cart **122**. Once each two-part housing **130** is in its open position, the cart **122** can be rolled out of the entire assembly line, with relative ease as a single unit. Thereafter, the operator can perform maintenance on and/or clean the vacuum coater head assembly **102**. Subsequently, the operator can change the coating (e.g., color) in the cart **122**. Once the desired operation is completed, the operator can simply wheel the cart **122** back into the main assembly line and reclose each two-part head assembly **102** around the part.

[0065] FIGS. **17-24** illustrate an embodiment of a light curing system **300**. After being sprayed by the vacuum coater head assemblies **102**, the vacuum coating system **100** feeds the part through a series of light assemblies **302** for curing of the coating(s) on the part. In other words, the light curing system **300** is configured to receive the part and cure the coating sprayed onto the part by exposing the coating to light. The light curing system **300** can utilize visible light sources and/or ultraviolet (UV) light sources for curing the part. For example, in one embodiment, the light curing system **300** exposes the coating to UV light. The light curing system **300** generally includes a thermoregulated light housing **304**, with UV blocking windows and/or doors **306**, a plurality of light arrays **308** each including a plurality of light assemblies **302** and housed within the light housing **304**.

[0066] The light housing **304** generally includes an inlet **310** for receiving the part therethrough and an outlet **312** for expelling the part therefrom. The inlet **310** and outlet **312** are coaxial with one another along a longitudinal axis **314** of the light assembly **302**. Hence, the part extends along the longitudinal axis **314** of the light curing system **300** and is transferred along the longitudinal axis **314** through the light curing system **300** when the light curing system **300** is operating. The inlet **310** comprises an inlet cover **316** configured to attach to the light housing **304** at an inlet hole **318** through the light housing **304** such that the part can extend through the inlet cover **316** (FIG. **1**). The outlet **312** comprises an outlet cover **320** configured to attach to the light housing **304** at an outlet hole **322** through the light housing **304** such that the part can extend through the outlet cover **320** (FIG. **1**). Each of the inlet cover **316** and the outlet cover **320** has an aperture **324** therethrough corresponding to a size and shape of the part (FIG. **1**). The inlet cover **316** extends outwardly from the light housing **304** and serves to block or cover the light assemblies **302** so that the part is protected from the light emitting therefrom, preventing premature curing of the part before entry into the light housing **304**.

[0067] The light arrays **308** are spaced apart from one another along the longitudinal axis **314** within the light housing **304**. Each light array **308** comprises a frame **330** (FIG. **20**) configured to support the plurality of light assemblies **302** about the longitudinal axis **314** such that a light source **332** of each light assembly **302** faces the longitudinal axis **314**. Each light assembly **302** is radially adjustable with respect to the longitudinal axis **314** via the frame **330**. In an example, each light assembly **302** is clamped to the frame **330** and is radially adjustable with respect to the longitudinal axis **314** via the frame **330**. In particular, a clamp **334**, which is connected to the frame **330** via a mounting bracket **336**, movably mounts a rod **338** that is connected to a respective light assembly **302** (FIG. **20**). Thereby, the rod **338** is configured to be clamped to the frame **330** of the light array **308** such that the light assembly **203** is radially adjustable relative to the longitudinal axis **314**, by moving the clamp **334** along the rod **338** (and/or via moving the rod **338** relative to the clamp **334**), while the frame **330** remains fixed relative to the longitudinal axis **314**. The light assemblies **302** extend parallel to the longitudinal axis **314** within the light housing **304**. The light assemblies **302** (and rods **338**

and clamps **334**) are radially offset or misaligned relative to one another, which promotes even curing around a circular part. In one embodiment, the rod **338** can be disposed within a protective rod sheath **340** and stabilized by a mounting sleeve **342** that is rigidly connected to the frame **330**.

[0068] In one embodiment, the frame **330** of the light array **308** comprises a mounting dial or disc that movably mounts two or more light assemblies **302** thereon. In another embodiment, the frame **330** can comprise a flat plate or a series of interconnected beams. As shown, the frame **330** of the light array **308** mounts eight light assemblies **302**. The frame **330** includes a central aperture or opening (unnumbered) which receives the part therethrough. The frame **330** can be fixed or be configured to move up or down and/or rotate relative to the light housing **304**, via one or more motors coupled thereto. In one embodiment, the light curing system **300** includes three or more light arrays **308**.

[0069] In one embodiment, each light assembly **302** is automatically movable by one or more motors. For example, a servo motor can be coupled to the rod **338** to move the rod **338** relative to the clamp **334** and thus radially raise or lower (i.e., retract or extend) a respective light assembly **302**. Each rod **338** can slide within a rod mount, or track. Thereby, the light assemblies can be moved automatically to accommodate variously sized parts to set appropriate cure distances between the light emanating from the light assemblies and the part.

[0070] Referring specifically to FIGS. **22-24**, each light assembly **302** of the plurality of light assemblies **302** comprises one or more light sources **332**, which extend longitudinally and parallel to the longitudinal axis **314**. Each light source **332** is configured to emit light toward the part. Each light assembly **302** also includes one or more reflectors **344** configured to reflect light (emanating from the light source or bouncing off of the part) toward the part. In one embodiment, each light assembly **302** includes a pair of bottom reflectors **344**, wherein each reflector **344** respectively extends longitudinally aside the light source **332** at an opposing side **346** (or underside side) of the light source **332**. The reflectors **344** are configured to redirect light emitted laterally or circumferentially by the light source **332** toward the longitudinal axis **314**. In one embodiment, the pair of reflectors **344** extend radially inward relative to the light source **332**. In one embodiment, each reflector of the pair of reflectors **344** is flat and extends away from the light source **332** as the reflector **344** extends radially inward relative to the light source **332**.

[0071] In one embodiment, each light assembly **302** includes a light box **348** and the light source **332** extending longitudinally along and disposed within the light box **348**. The rod **338** extends radially outward from the light box **348**. The light box **348** is rigidly coupled to a distal end of the rod **338**. The light box **348** includes a top **350**, an open bottom **352**, front and back longitudinal ends **354**, **356**, and lateral sidewalls **358**. The lateral side or sidewall **358** is formed between the bottom **352** of the light box **348**, the top **350** of the light box **348**, and the longitudinal ends **354**, **356** of the light box **348**.

[0072] One or more light reflectors **344**, **360** are connected to the light box **348**. In one embodiment, each light assembly **302** includes bottom reflectors **344** and a side reflector **360** that extends from the lateral side **358** of the light box **348**. The side reflector **360** comprises a bottom mounting portion that extends along the side **358** of the light box **348** and a bent and substantially flat reflecting portion, extending outwardly from the mounting portion, for redirecting light toward the part. The reflecting portion extends outwardly to a distal end, distally away from the light box **348**.

[0073] Each light reflector **344**, **360** can be rigidly mounted to the light box **348** via fasteners or spot welding. Each light reflector **344**, **360** can be made of sheet metal that is bent in a particular manner to best distribute the light emanating from the light source(s) **332**. For example, in one embodiment, each bottom light reflector **344** includes an upper, mounting portion configured to mount onto the light box **348** (or onto the side reflector **360**). Each bottom light reflector **344** also includes an inwardly extending intermediary portion extending inwardly from the mounting portion such that at least a portion of light emanating from the one or more light sources **332** within the light box **348** is blocked by the inwardly extending portion, and a reflecting portion extending downwardly and outwardly from the intermediary portion. The reflecting portion is configured to intensify and direct the light emanating from the one or more light sources **332** within the light box **348** toward the part.

[0074] When curing a given part, light leaving the light box **348** hits the part and cures the coating thereon. Some light may escape around the sides of the bottom reflectors **344** before contacting the part, and some light may reflect off of the part and back outwardly toward the sides of the light box **348** (and around the bottom reflectors **344**). The side reflector **360** on each light box **348** in turn captures this light and redirects the light toward the part. In effect, the side reflector **360** serves as a secondary light source **332** at the side of the light box **348**, which in turn reduces curing time, increases the feed rate, and reduces energy consumption.

[0075] Upon adjusting the position of the light assemblies **302** closer to or further away from the longitudinal axis **314**, the light boxes **348** will move closer together or further away from one another. FIG. **20** illustrates the light assemblies **302** in a possible retracted position, wherein the light assemblies **302** are located radially further away from the part and the longitudinal axis **314**. FIG. **21** illustrates the light assemblies **302** in a possible extended position, wherein the light assemblies **302** are located radially closer to the part and the longitudinal axis **314**. When the light assemblies **302** are closer to the longitudinal axis **314**, the side reflector **360** extends radially outward beyond the top of the light box **348** and laterally above the top of the light box **348**, away from another lateral side **358** of the light box **348** such that the side reflector **360** extends laterally beyond a sidewall **358** of a light box **348** of a next light assembly **302** (i.e., juxtaposed light assembly **302**) in the light array **308**.

[0076] Known prior art reflectors are positioned below the light source and cannot recapture and redirect any light that has escaped past the bottom edge of a prior art light box. In contrast thereto, the side reflector **360** has a reflecting portion that is located above the light source **332** for redirecting light toward the part. Additionally, these significant improvements attributable to the side reflector **360** were not seen or suggested by such prior art light reflectors that only direct light from below the light source.

[0077] This written description uses examples to disclose the invention and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

[0078] It will be understood that the particular embodiments described herein are shown by way of illustration and not as limitations of the invention. The principal features of this invention may be employed in various embodiments without departing from the scope of the invention. Those of ordinary skill in the art will recognize numerous equivalents to the specific procedures described herein. Such equivalents are considered to be within the scope of this invention and are covered by the claims.

[0079] All of the compositions and/or methods disclosed and claimed herein may be made and/or executed without undue experimentation in light of the present disclosure. While the compositions and methods of this invention have been described in terms of the embodiments included herein, it will be apparent to those of ordinary skill in the art that variations may be applied to the compositions and/or methods and in the steps or in the sequence of steps of the method described herein without departing from the concept, spirit, and scope of the invention. All such similar substitutes and modifications apparent to those skilled in the art are deemed to be within the spirit, scope, and concept of the invention as defined by the appended claims.

[0080] Thus, although there have been described particular embodiments of the present disclosure it is not intended that such references be construed as limitations upon the scope of this invention except as set forth in the following claims.

What is claimed is:

1. A light curing system comprising:
a light array configured to provide light to a part and cure a coating on the part, the light array comprising a plurality of light assemblies; and
a housing comprising:
an inlet for receiving the part therethrough; and
an outlet for expelling the part therefrom, wherein the inlet and outlet are coaxial with one another along a longitudinal axis of the light assembly.

2. The light curing system of claim **1**, wherein:
the part extends along the longitudinal axis of the light curing system and is transferred along the longitudinal axis through the light curing system when the light curing system is operating.

3. The light curing system of claim **1**, wherein:
the inlet comprises an inlet cover configured to attach to the housing at an inlet hole through the housing such that the part can extend through the inlet cover; and
the inlet cover has an aperture therethrough corresponding to a size and shape of the part.

4. The light curing system of claim **1**, wherein:
the outlet comprises an outlet cover configured to attach to the housing at an outlet hole through the housing such that the part can extend through the outlet cover; and
the outlet cover has an aperture therethrough corresponding to a size and shape of the part.

5. The light curing system of claim **1**, wherein:
the plurality of light assemblies extend parallel to the longitudinal axis within the housing.

6. The light curing system of claim **1**, wherein:
the plurality of light assemblies extend parallel to the longitudinal axis within the housing; and
the light array comprises a frame configured to support the plurality of light assemblies about the longitudinal axis such that a light source of each light assembly faces the longitudinal axis.

7. The light curing system of claim **1**, wherein:
the plurality of light assemblies extend parallel to the longitudinal axis within the housing;
the light array comprises a frame configured to support the plurality of light assemblies about the longitudinal axis such that a light source of each light assembly faces the longitudinal axis; and
each light assembly of the plurality of light assemblies is radially adjustable with respect to the longitudinal axis via the frame.

8. The light curing system of claim **1**, wherein:
the plurality of light assemblies extend parallel to the longitudinal axis within the housing;
the light array comprises a frame configured to support the plurality of light assemblies about the longitudinal axis such that a light source of each light assembly faces the longitudinal axis; and
each light assembly of the plurality of light assemblies is clamped to the frame and is radially adjustable with respect to the longitudinal axis via the frame.

9. The light curing system of claim **1**, wherein:
the light curing system further comprises a plurality of light arrays;
the light array is one of the plurality of light arrays; and
the plurality of light arrays are spaced apart from one another along the longitudinal axis within the housing.

10. The light curing system of claim **1**, wherein:
a light assembly of the plurality of light assemblies comprises:
a light source extending longitudinally, the light source is configured to emit light toward the part.

11. The light curing system of claim **1**, wherein:
a light assembly of the plurality of light assemblies comprises:
a light source extending longitudinally, the light source is configured to emit light toward the part; and
a pair of reflectors, each reflector of the pair of reflectors respectively extending longitudinally aside the light source at an opposing side of the light source.

12. The light curing system of claim **1**, wherein:
a light assembly of the plurality of light assemblies comprises:
a light source extending longitudinally, the light source configured to emit light toward the part; and
a pair of reflectors, each reflector of the pair of reflectors respectively extending longitudinally aside the light source at an opposing side of the light source, wherein the pair of reflectors are configured to redirect light emitted laterally or circumferentially by the light source toward the longitudinal axis.

13. The light curing system of claim **1**, wherein:
a light assembly of the plurality of light assemblies comprises:
a light source extending longitudinally, the light source configured to emit light toward the part; and

a pair of reflectors, each reflector of the pair of reflectors respectively extending longitudinally aside the light source at an opposing side of the light source, wherein:
the pair of reflectors are configured to redirect light emitted laterally or circumferentially by the light source toward the longitudinal axis; and
the pair of reflectors extend radially inward relative to the light source.

14. The light curing system of claim **1**, wherein:
a light assembly of the plurality of light assemblies comprises:
a light box;
a light source extending longitudinally along the light box, the light source configured to emit light toward the part; and
a pair of reflectors, each reflector of the pair of reflectors extending longitudinally along the light box aside the light source at an opposing side of the light source, wherein:
the pair of reflectors are configured to redirect light emitted laterally or circumferentially by the light source toward the longitudinal axis;
the pair of reflectors extend radially inward relative to the light source; and
each reflector of the pair of reflectors is flat and extends away from the light source as the reflector extends radially inward relative to the light source.

15. The light curing system of claim **1**, wherein:
a light assembly of the plurality of light assemblies comprises:
a light box;
a light source extending longitudinally along the light box, the light source configured to emit light toward the part; and
a rod extending radially outward from the light box, the rod configured to be clamped to a frame of the light array by a clamp such that the light assembly is radially adjustable relative to the longitudinal axis, while the frame remains fixed relative to the longitudinal axis.

16. The light curing system of claim **1**, wherein:
a light assembly of the plurality of light assemblies comprises:
a light box having longitudinal ends;
a light source extending longitudinally along the light box, the light source configured to emit light toward the part, wherein the light source is at a bottom of the light box;
a rod extending radially outward from the light box opposite the light source, wherein the rod extends from a top of the light box; and
a side reflector extending from a lateral side of the light box, the lateral side formed between the bottom of the light box, the top of the light box, and the longitudinal ends of the light box.

17. The light curing system of claim **1**, wherein:
a light assembly of the plurality of light assemblies comprises:
a light box having longitudinal ends;
a light source extending longitudinally along the light box, the light source configured to emit light toward the part, wherein the light source is at a bottom of the light box;
a rod extending radially outward from the light box opposite the light source, wherein the rod extends from a top of the light box; and
a side reflector extending from a lateral side of the light box, the lateral side formed between the bottom of the light box, the top of the light box, and the longitudinal ends of the light box, wherein:
the side reflector extends radially outward beyond the top of the light box and laterally above the top of the light box, away from another lateral side of the light box such that the side reflector extends laterally beyond a sidewall of a light box of a next light assembly in the light array.

18. The light curing system of claim **1**, wherein:
a light assembly of the plurality of light assemblies comprises:
a light box having longitudinal ends; and
a light source extending longitudinally along the light box, the light source configured to emit light toward the part, wherein the light source is at a bottom of the light box, wherein the light source is an ultraviolet light source.

19. A vacuum coating system comprising:
a vacuum coater head assembly configured to receive a part to be coated, spray a coating onto the part, and recover excess sprayed coating;
a cart configured to support the vacuum coater head assembly;
a pump configured to provide the coating to the vacuum coater head assembly under pressure for spraying the coating onto the part and receive the recovered excess coating from the vacuum coater head assembly, wherein the pump is mounted on the cart; and
a light curing system comprising:
a light array configured to provide light to a part and cure a coating on the part, the light array comprising a plurality of light assemblies; and
a housing comprising:
an inlet for receiving the part therethrough; and
an outlet for expelling the part therefrom, wherein the inlet and outlet are coaxial with one another along a longitudinal axis of the light assembly.

20. The vacuum coating system of claim **19**, further comprising:
a vacuum blower configured to draw air from the vacuum coater head assembly.

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