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(54) **Title**: SYSTEM FOR PLUG-IN TYPE DETACHABLE CONSTANT CURRENT DRIVER ADAPTOR FOR LED TUBE LIGHTS FOR DIFFERENT TYPES OF FIXING OR INSTALLATION

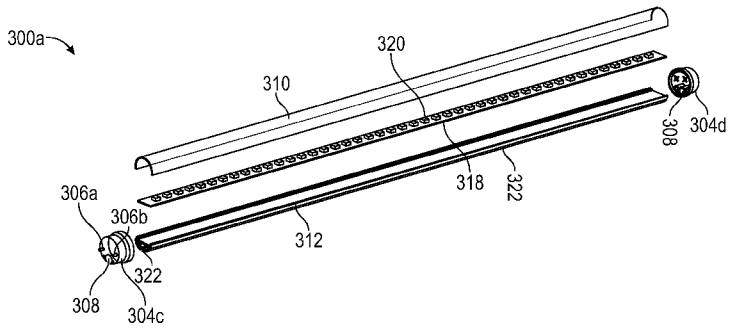

FIG. 3A

(57) **Abstract**: Exemplary embodiments of the present disclosure are directed towards a system for plug-in type detachable constant current driver adaptor for LED tube lights for different types of fixing. The system includes, a first driver embodiment and a second driver embodiment, whereby the first driver embodiment secured to at least one end cap for retrofitting the light emitting diode (LED) tube light of a conventional fixture and whereby the second driver embodiment secured to the end caps and fixed to the LED tube light with the plurality of G13 pins for converting into to wall mounting; and hanging configuration. The system also includes a light emitting diode (LED) printed circuit board (PCB), a plurality of surface- mounted-device (SMD) light - emitting diodes (LED), a polycarbonate (PC) diffuser and at least two end caps with G13 male pins, the polycarbonate (PC) diffuser cover further compris-ing an aluminum heat sink. The aluminum heat sink placed at the back side of the light emitting diode (LED) tube body and which further comprising a conduit at the back side of the light emitting diode (LED). Detachable driver end cap housing comprises at least two G13 female socket, a wire hole and at least two fixings crews, further coupled to the aluminum heat sink. A power supply wire passes through a wire hole from a driver housing, passing through the inner end caps and finally through the conduit in the alumin-um heat sink in a concealed manner from normal vision to improve aesthetics and protect the wire. The detachable driver end cap housing used for retrofitting and wall mounting: and hanging installations with built in common driver suitable for the common light emitting diode (LED) tube, The detachable driver housing end cap will also be used installing sensors, battery backup, dimming and automatic ambient light adjustment. A low cost plastic accessory to convert a retrofit LED tube light into wall mounting: and hanging fixtures.

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SYSTEM FOR PLUG-IN TYPE DETACHABLE CONSTANT CURRENT DRIVER ADAPTOR FOR LED TUBE LIGHTS FOR DIFFERENT TYPES OF FIXING OR INSTALLATION

TECHNICAL FIELD

[001] The present disclosure relates to the field of light emitting diode (LED) lighting, controls and installation technology. More particularly, the present disclosure relates to LED Tube lights with a system for plug-in type detachable constant current driver located in the end cap suitable for different types of fixing or installation and using end caps to customize LED tube lights for automatic control and operation, wireless connectivity and to provide battery backup power as and when required.

BACKGROUND

[002] Generally, fluorescent or incandescent lamps are widely used in artificial lighting. Among the two fluorescent lamp is much preferred in general purpose lighting as it offers higher efficiency, consumes less power, delivers higher lumens, generates low heat and has long life compared to incandescent lamps. It used in the form of tube lights, CFL in various size and shapes. The fluorescent tube lights are generally in sizes 1500mm, 1200mm, 600mm, 300mm and vary in diameter and classified as T12, T8, T5. They are installed in sheet metal fixtures or holders that are integrated with magnetic ballast with a starter or electronic ballast and with power supply on both ends through metal pins classified as G13 size. T8 and T12 tube lights are manufactured with metal end caps with G13 PINs suitable for G13 holder of the fixture. Even though lamps vary in length, size of the end caps or G13 pins is standard in T8/T12 diameter. Tube lights constitute 55% of general purpose lighting in the residential sector and 58% of commercial sector in India and they are the most used lamps worldwide.

[003] Lighting technology based on Light Emitting Diodes usually called as LED has rapidly gained popularity due to 50% higher efficiency, long life, more directional in light delivery than florescent lamps. LED lights are classified as luminaires that are designed in different shapes and sizes to fulfill the lighting requirements as per applications and as retrofit lamps designed in a form compatible to replace conventional lamps like bulbs and tube lights.

LED bulbs are widely used to address power consumption in lighting as it is easy to replace conventional incandescent, halogen or CFL lamps in designed suitable for different sockets or holders.

[004] **Complexities in retrofitting Tube lights:** LED Tube lights are also being used to replace conventional florescent tube lights, but not as widely as bulbs, due to complexities involved in modifying the tube light fixtures to suit LED tube lights and skilled people are required to do the job.

[005] LED tube lights like all other LED lights requires a constant current supply device to supply power to LED components and are simply called drivers. Initially LED driver circuits or assembly were large in size and were placed externally like the choke of the conventional tube lights. Later the drivers were designed in small form factor suitable to integrate in to the extruded aluminum heat sink along with the LED PCB. LEDs as components have very long life compared to the electronic drivers due to low life of the capacitors used in the circuit. Drivers are prone to failures due to electrical fluctuations or other reasons and often require highly skilled technical persons to repair or replace failed drivers which are highly expensive too. This can only be accomplished either through onsite service or customers have to carry the tube light to the service or dealer point for rectification. Due to the high cost of service lamp failures are often addressed by replacing the lamp with new, during warranty period or the customer has to discard the LED tube light and buy new one after warranty.

[006] **Driver failures wasting useful lamps:** Drivers constitute only 20% of the value of total LED tube light and 80% of the useful lamps are discarded due to the complexities in replacing failed drivers. This constraint is also resulting in generation of avoidable electronic waste resulting in other environmental hazards.

[007] Further, LED tube lights are many times expensive than the conventional florescent tube lights and the uncertainties involved in the useful life of the LED tube lights, together with the complexities in retrofitting are keeping many users in wait in spite of huge benefits offered in terms of savings in energy and operational costs.

[008] **Accelerated Lumen Depreciation:** Another problem in the existing design of LED tube lights is the heat generated by the driver assembly that gets transmitted to the LED PCB

as common heat sink is used by both. Heat accelerates the lumen depreciation of LEDs and reduces their life. Also most customers in existing buildings are choosing to retrofit the conventional fluorescent lamps with LED tube lights in the existing fixtures. But customers of new buildings prefer LED batten Tube lights that can be directly mounted without any need for a fixture, to simplify installation and improve on aesthetics.

[009] **Lack of unified standard in design:** Different LED retrofit tube light models are available in the market with varying designs and standards. Some LED Tube lights require one end power and some on both ends of the fixture. There are some models available that can be directly installed in fixtures with magnetic ballast and some compatible to electronic ballast and it is often difficult and confusing for the common consumer. Even in LED Lamps designed for direct replacement of existing fixtures, the ballast continues to exist in the circuit and will consume some power without any purpose.

[010] This requirement of rewiring of existing fixtures makes the process of retrofitting complicated, labor intensive and adds additional cost to project over and above the cost of LED retrofit tube lights. Further the process requires technically qualified persons and common people cannot execute the job like with LED Bulbs.

[011] Due to this reason most Demand Side Management (DSM) programs sponsored by governments offer LED bulbs to save energy. But, except for users of Below Poverty Line (BPL), others commonly use tube lights for task lighting, which leaves large and unaddressed power consumption in the lighting.

[012] **Design drawbacks in Batten Models:** Generally, Civil Engineers and Electricians provide power supply for the tube lights at the center of the tube light closer to the placement of choke of conventional tube lights. This creates a problem with LED batten tube lights having one side power with 2 feet wire being visible and creating shabby look.

[013] Currently available retrofit and batten models are made with semi-finished components of different specifications. This requires large investment in tooling and raw material stock and finished goods stock. Even dealers and distributors need to keep stock of many different models to fulfill the requirements of customers. Further customers are stuck with a LED tube light of particular specifications and cannot add or remove any feature like

sensor based auto switching, dimming or any other feature and have buy a new tube light again with the required features suitable for the requirement.

[014] In the light of aforementioned discussion there exists a need for system that would ameliorate or overcome the above mentioned disadvantages.

BRIEF SUMMARY

[015] The following presents a simplified summary of the disclosure in order to provide a basic understanding to the reader. This summary is not an extensive overview of the disclosure and it does not identify key/critical elements of the invention or delineate the scope of the invention. Its sole purpose is to present some concepts disclosed herein in a simplified form as a prelude to the more detailed description that is presented later.

[016] A more complete appreciation of the present invention and the scope thereof can be obtained from the accompanying drawings which are briefly summarized below and the following detailed description of the presently preferred embodiments.

[017] Exemplary embodiments of the present disclosure are directed towards a system for plugin type detachable constant current driver adaptor for LED tube lights for different types of fixing or installation.

[018] An exemplary objective of the present disclosure is to provide faults in the light emitting diode (LED) drivers, which could be easily changed by plug-out and plug-in and reduce the down time of the lamp and provide with convenience of rectification by any one.

[019] Another exemplary objective of the present disclosure is to provide drivers which are easy to transport due to small size compared to the large size and shape of tube lights.

[020] Another exemplary objective of the present disclosure is to provide a possibility to change the fixing type from retrofit to wall mount or hanging without wasting the tube light and the aluminum rod penetrates through the aluminum rod inserting bracket at the both ends of the light emitting diode (LED) driver housing, which can be used for locking purpose. During slide motions the aluminum rod locking with fixing screws to prevent the light emitting diode (LED) driver housing from the thefts.

[021] Another exemplary objective of the present disclosure is to provide the light emitting diode (LED) tube lights manufactured in volume in any length and drivers can be plugged in later before delivery enabling the manufacturer, distributor and dealers to reduce inventory and stock of finished LED tube lights and only keep stock of different end caps that would help in customization of fixing type or add additional features like dimming or add sensor relay switches for automation. Customer can have the tailor made LED tube light for their requirements at the time of purchase or easily modify even after purchase to suit the site condition. This driver designs by offering different driver end caps instead of complete tube lights for each requirement.

[022] Another exemplary objective of the present disclosure is to increase life time of light emitting diode (LED) in application of LED in lighting due to higher efficiency, lesser power consumption and long life.

[023] According to an exemplary embodiment, the system includes the LED PCB, LED driver, poly carbonate (PC) diffuser, aluminum extruded heat sink and plastic end cap with G13 pins that will be common for all models and different additional end caps and housings for customization in installation and operation.

[024] Another exemplary objective of the present disclosure is to provide the customers have wide requirements like retrofitting in the existing fixtures or wall mounting directly for this driver designs without the need for separate fixture or sometimes the site conditions with high roofs require that the tube light should be hung from the ceiling to reduce the height. Even though LED tube lights can save energy consumption to the extent greater than 50%, it is possible to further increase the saving by adding special features like dimming or incorporating sensor relay for automation in control.

[025] According to an exemplary embodiment, the system includes the LED tube light that is manufactured in the shape of conventional tube lights with G13 pins but shorter in length. The driver end caps will be made in such a way to fit on to the G13 pins (like male female sockets) of the LED tube light to make it complete to fix the tube light in the existing fixture or wall mount it directly or hang it from the roof. The G13 end cap on the other end of the driver end cap can be used to incorporate special circuits like dimming or sensor relay for

automation. The driver designs will simplify the manufacturing process, reduce inventory drastically and also reduce the investment.

[026] Exemplary embodiments of the present disclosure are directed towards a system where LED tube lights are manufactured in the shape of conventional tube lights with G13 pins on both ends but shorter in length than the standard tube lights.

[027] An exemplary objective of the present disclosure is to provide two plastic end caps with a housing are designed in a way to press fit on to the G13 pins (with G13 female sockets) one both ends of the short LED tube light to make it complete in length suitable to fix it in the existing fixture or mount directly on wall or ceiling or hang it.

[028] Another exemplary objective of the present disclosure is to provide one of the two plastic end caps will be used to install the driver circuit PCB required to power the LED tube light on one end of the tube and the other end cap housing will be used to install circuits with special or additional features like sensor control for switching automation, light dimming or switching as per ambient light conditions or wireless connectivity for remote control and monitoring or providing a power backup with batteries and their charging circuit to fulfill the additional requirements of the customer or to enhance the performance of the tube light.

[029] Another exemplary objective of the present disclosure is to provide the attachable/detachable plastic end cap housing will be designed in different shapes suitable to retrofit in existing fixtures with G13 pins or for wall/ceiling mounting or hanging.

[030] According to an exemplary embodiment, the system includes, the plastic end cap housings of both retrofit or wall mountable versions will have a hole to draw a 2-core cable connected to the driver circuit PCB and designed to pass the wire cable internally in to the conduit provided on the back side of the aluminum heat sink and the wire can be pulled out from any point along the length of the tube light to connect to the mains supply point provided on the wall or ceiling.

[031] Another exemplary objective of the present disclosure is to provide these concealed power cable will be used to connect the driver directly to the mains supply without involvement of the exiting fixture to supply power. This design feature can completely

eliminate the complexities involved in rewiring or modifying the existing fixtures. Retrofitting existing fixtures can be achieved in a simple three step process of disconnecting the power supply wire of the existing fixture, installation of the LED tube light and reconnecting power supply wire directly to the input wire of the LED tube light. The wiring circuit along with choke and starter in the fixture will remain undisturbed and the fixture will be used only to hold the LED tube light. Customers can revert back to old system any time by just reconnecting power to the fixture and use it for florescent lamps if they choose to.

[032] An exemplary objective of the present disclosure is to eliminate the complexities and simplify the retrofit process which can be executed even by common consumers.

[033] An exemplary objective of the present disclosure is to address failures of the electronic drivers, which could be easily changed by plug-out and plug-in of end caps and reduce the down time of the lamp and extend the life of lamp and provide with convenience of rectification by the users themselves.

[034] Another exemplary objective of the present disclosure is to supply drivers as spare parts at low cost and to eliminate the difficulties involved in shipping complete LED tube light in the event of driver failure.

[035] Another exemplary objective of the present disclosure is to reduce the time and cost to rectify driver failures in critical areas and institutions as they can maintain spare drivers at fraction of the cost of complete LED tube lights and rectification can be addressed fast.

[036] Another exemplary objective of the present disclosure is to provide a possibility to change the fixing type from retrofit to wall mount or hanging without wasting the tube light and to protect the LED Tube Lights from the thefts.

[037] Another exemplary objective of the present disclosure is to use the second end of the LED tube light G13 pins along with the compatible end cap housing to add special features to the lamp like sensor controls for switching and dimming as per ambient light and others as mentioned above, whenever required.

[038] Another exemplary objective of the present disclosure is to standardize the design of the LED tube light suitable for all types of fixing and applications and minimize the inventories of raw material, semi-finished, finished tube lights to reduce the investment, cost of manufacturing and increase productivity. Even dealers and distributors can address all the requirements of customers with one LED Tube light by integrating it with the suitable end caps to fulfill the needs of the customer and site conditions. Customer can have a tailor made LED tube light for their requirements at the time of purchase or modify even after purchase without having to change the entire LED tube light.

[039] Another exemplary objective of the present disclosure is to increase life time of the LED tube light by allowing change drivers as and when they fail without the need to change total lamp and reduce generation of unnecessary electronic waste and maximize ROI for the users.

[040] Another exemplary objective of the present disclosure is to protect the LEDs from the heat produced by the driver circuit by isolation and to reduce the rate of lumen depreciation.

[041] Another exemplary objective of the present disclosure is encourage large scale DSM programs involving distribution of LED tube lights of one model suitable for all types of installation, easy maintenance with improved operational life for achieving maximum results in saving energy and reducing peak time load by governments.

BRIEF DESCRIPTION OF DRAWINGS

[042] Other objects and advantages of the present invention will become apparent to those skilled in the art upon reading the following detailed description of the preferred embodiments, in conjunction with the accompanying drawings, wherein like reference numerals have been used to designate like elements, and wherein:

[043] FIG. 1A and FIG. 1B are (Prior Art) diagrams depicting a fluorescent tube light system.

[044] FIG. 2A (Prior Art) is a diagram depicting LED (Light Emitting Diode) Tube light system with external driver. FIG. 2B (Prior Art) is a diagram depicting LED Tube light system with integrated internal driver.

[045] FIG. 3A and FIG. 3B are diagrams depicting an exploded and assembled views of a common light emitting diode (LED) tube light system, without driver which is made in shorter length than the standard lengths of 300mm, 600mm,1200mm or 1500mm according to an exemplary embodiment of the present disclosures.

[046] FIG. 3C – 3F are diagrams depicting a front and isometric views of a detachable end caps for retrofitting configuration, according to an exemplary embodiment of the present disclosures. These detachable end cap housings 3C - 3F are used to install constant current driver and plug in to the common tube light 3A - 3B to make the LEDs of the tube light operational and also make 3A complete as per standard length as per the embodiment of current disclosure.

[047] FIG. 3G and FIG. 3H are diagrams depicting exploded and assembled views of a detachable end caps suitable for housing electronic circuit and plugged on to either side of common tube light 3A,3B. The end cap housing FIG 3C to 3H will be used to install LED driver circuit, switching sensors, dimming and battery power for backup in retrofitting configuration, according to an exemplary embodiment of the present disclosures.

[048] FIG. 4A - FIG 4B are diagrams depicting a front and isometric views of a detachable driver housing and end caps for wall mounting and hanging configuration, these end caps are suitable for installing electronic circuit and plugged on to either side of common tube light 3A-3B. The end cap housing FIG 4A- 4B will be used to install LED driver circuit, switching sensors, dimming, battery power for backup or any other circuit wall mounting configuration, according to an exemplary embodiment of the present disclosures.

[049] FIG. 4C and FIG. 4D are diagrams depicting exploded and assembled views of a detachable driver housing and end caps suitable for wall mounting and hanging configuration, according to an exemplary embodiment of the present disclosures.

[050] FIG. 4E and FIG. 4F are diagrams depicting exploded and assembled views of a low cost accessory to convert retrofit LED tube light with detachable driver in to wall mounting

and hanging type by using the plastic end cap fixtures, according to an exemplary embodiment of the present disclosures.

DETAILED DESCRIPTION

[051] It is to be understood that the present disclosure is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the drawings. The present disclosure is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

[052] The use of "including", "comprising" or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. The terms "a" and "an" herein do not denote a limitation of quantity, but rather denote the presence of at least one of the referenced item. Further, the use of terms "first", "second", and "third", and the like, herein do not denote any order, quantity, or importance, but rather are used to distinguish one element from another.

[053] Referring to FIG. 1A and FIG. 1B are (Prior Art) diagrams100a and 100b depicting a fluorescent tube light system. The system100a and 100b includes a tube body 102, G13 end caps lamp holder 104a and 104b, G13 pins 106a , 106b, 106c and 106d, a first end 108 and a second end 110, a starter 112, inductive ballast 114, a line voltage 116, a metal fixture 118, an input power source 120 and power cables 122a and 122b. The cylindrical shape tube body 102 includes a first end 108 and a second end 110, which are fixed with end caps 104a and 104b. The G13 pins 106a and 106b protrude from the end caps 104a and 104b.

[054] As shown in FIG. 1A and FIG. 1B are (Prior Art), the light driver is electrically connected to the fluorescent tube light. The starter 112 connected between the G13 pins 106a and 106b is to provide an initial current to filaments of the tube light. The inductive ballast 114 connected to the multiple G13 pins 106a and 106b and which is used to limit the current through the tube light. The line voltage 116 is supplied to the fluorescent tube light. The fluorescent tube light100a and 100b is installed in a sheet metal fixture 118 manufactured

with electrical ballast 114 and starter 112. Power is supplied through the power cables 122a and 122b from the input power source 120 and provided from the wall point at the center of the fixture 118.

[055] Referring to FIG. 2A (Prior Art) is a diagram 200a depicting LED (Light Emitting Diode) tube light system with external driver. FIG. 2B (Prior Art) is a diagram 200b depicting LED tube light system with integrated internal driver. The system 200a and 200b includes a tube body 202, end caps 204a and 204b, G13 pins 206a and 206b, 206c and 206d, a first end 208 and a second end 210, Here the starter is replace by shorting G13 pin 206c & G13 pin 206d and is represented as 212 , Constant current driver 214, a line voltage 216, a driver PCB 218, an aluminum printed circuit board (PCB) 220, an insulating sleeve 222, a light-emitting diode surface-mount-device (LED SMD) 224, a PC cover 226 and a wire connection 228. The cylindrical shape tube body 202 includes a first end 208 and a second end 210, which are coupled to the end caps 204a and 204b by screws.

[056] As shown in FIG. 2A and FIG. 2B (Prior Art), the G13 pins 206a and 206b protrude from the end caps 204a and 204b, the end caps 204a and 204b with the G13 pins suitable for installing the tube in the tube light fixture. The line voltage 216 is supplied to the light emitting diode (LED) tube light through G13 pins 206a and 206b. The inductive ballast 214 connected to the G13 pins 206a and 206b.The shorting G13 pin 206c & G13 pin 206d and is represented as 212. The external driver 214 inserting in the light emitting diode (LED) tube light system (as shown in FIG. 2A), supplies constant current to the LEDs for their operation.

[057] As shown in FIG. 2A and FIG. 2B (Prior Art), the light emitting diode (LED) tube light manufactured with integrated driver 218 (as shown in FIG. 2B), which is connected with wire connection 228 to the protruded G13 pins 206a and 206b. The light emitting diode (LED) tube light manufactured with Poly carbonate diffuser 226, Aluminum extrusion 230with guides for insertion of the LED printed circuit board (PCB) 220 with mounted light-emitting diode surface-mount-device (LED SMD) 224and also acts as heat sink; the constant current driver PCB 218 is wrapped with insulating sleeve 222 to prevent transfer of heat to LEDs 224. The light emitting diode (LED) tube light with end caps 204a-204b and the G13 pins 206a - 206b are manufactured to suit to retrofit fixtures.

[058] As shown in FIG. 2A and FIG. 2B (Prior Art), the light emitting diode (LED) tube light enclosure with polycarbonate (PC) diffuser 226. The end caps 204a and 204b used to make the tube light suitable for retrofit in existing fixture. The driver 218 wires are soldered directly to the light emitting diode (LED) tube light end caps G13 pins, and which cannot be removed easily and requires special tools like soldering iron to replace driver 218 in the event of its failure. Another problem is the heat generated by the driver assembly gets transmitted to the LED printed circuit board (PCB) and accelerates the lumen depreciation of LEDs by increasing the junction temperature of LEDs and reduces the life of the LED tube lights.

[059] Referring to FIG. 3A and FIG. 3B are diagrams 300a, 300b depicting an exploded and assembled views of a common light emitting diode (LED) tube light system, without driver which is made in shorter length than the standard lengths of 300mm, 600mm, 1200mm or 1500mm (without limiting the scope of the disclosure), according to an exemplary embodiment of the present disclosures. The common light emitting diode (LED) tube light system 300a and 300b includes end caps 304c and 304d, G13 pins 306a and 306b, a power supply wire hole 308, a polycarbonate (PC) diffuser 310, an aluminum heat sink 312, a first end 314, a second end 316, FR4 grade printed circuit board (PCB) 318, a light-emitting diode surface-mount-device (LED SMD) 320 and a conduit 322. The common light emitting diode (LED) tube light comprising the first end 314 and the second end 316 of the light emitting diode (LED) tube light. The G13 pins 306a and 306b protrude from the end caps 304c and 304d of the first end 314 and the second end 316.

[060] As shown in FIG. 3A and FIG. 3B, the light emitting diode (LED) tube light enclosure with polycarbonate (PC) diffuser 310 further comprising the aluminum heat sink 312. The light emitting diode (LED) tube light enclosure with PC diffuser 310 houses the FR4 grade PCB 318 and the light-emitting diode-surface-mount-device (LED SMD) 320. The FR4 grade printed circuit board (PCB) 318 and the inbuilt light emitting diodes (LED) are separated from the inbuilt drivers, thus preventing the transfer of heat generated by driver to light-emitting diode surface-mount-device 320. The end caps 304c and 304d are screw fixed to the aluminum heat sink 312. The common LED tube light 300a and 300b does not include driver. The assembled view of a common light emitting diode (LED) tube light (as shown in FIG. 3B) is designed to be shorter in length than the standard length of 4feet and 2feet (without limiting the scope of the disclosure).

[061] Referring to FIG. 3C – 3F are diagrams 300c – 300f depicting a front and isometric views of a detachable end caps for retrofitting configuration, These detachable end cap housings 3C - 3F are used to install constant current driver and plug in to the common tube light 3A - 3B to make the LEDs of the tube light operational and also make 3A complete as per standard length as according to an exemplary embodiment of the present disclosures. The system includes an inbuilt constant current driver to supply power to light emitting diode (LED) PCB 318 depicted in FIG 3A and 3B. The driver housing 302a and 302b, driver end caps 304a and 304b, G13 pins 306a and 306b, G 13 female sockets 306c and 306d, a fixing screw328 and locking screws 308a and 308b. The locking screws 308a and 308b used to connect with the aluminum heat sink 312(as shown in FIG. 3A and FIG. 3B). The light emitting diode (LED) driver housing 302a - 302band the driver end caps 304a and 304bcoupled for retrofitting configuration (as shown FIG. 3F).

[062] Referring to FIG. 3G and FIG. 3H are diagrams 300g and 300h depicting exploded and assembled views of a detachable end caps suitable for housing electronic circuit and plugged on to either side of common tube light 3A,3B. The end cap housing FIG 3C to 3H will be used to install LED driver circuit, switching sensors, dimming and battery power for backup in retrofitting configuration, according to an exemplary embodiment of the present disclosures. The first design driver embodiment 300g and 300h includes the driver end caps 304a and 304b positioned at distal ends of the light emitting diode (LED) driver housing 302a and 302b. The driver housing 302a and 302b are plug-in secured with the G13 male and female socket 306a - 306d for allowing fitting in to standard tube light fixture. The provision for the G13 pins 306a and 306b of the light emitting diode (LED) tube light, inner end caps 304c and 304d to facilitate insertion of electrodes of the light emitting diode (LED) tube light, a protruded knob on driver housing 302a and 302b prevents reverse connection. Driver housing end caps 304a and 304b comprises a provision for the fixing screw 328 to the driver 302a and 302b. The end caps 304a, 304b, 304c and 304d and the driver housing 302a and 302b are assembled for retrofitting configuration (as shown in FIG. 3H) for the conventional fixture of the light emitting diode (LED) tube light.

[063] As shown in FIG. 3G and FIG. 3H, the aluminum heat sink 312 further comprises a conduit 322 at the back side of the tube light lamp. The power supply wire 326 is passed through the power supply wire hole 308 from the driver housing 302a and is passed through

end cap 304c and finally to the conduit 322 in the aluminum heat sink 312 in a concealed manner from normal vision to improve aesthetics and protect the wire. In existing retrofitting tube light fixtures with LED tube lights, wiring need to be changed suitably, in this design it is simplified to disconnect input wire and directly make the connection without rewiring. Further the in-built system for concealed wiring used to supply input power 324 at the center of the tube, makes the power connection simple and unique.

[064] Referring to FIG. 4A and FIG. 4B are diagrams 400a and 400b depicting a front and isometric views of a detachable driver housing and end caps for wall mounting and hanging configuration, these end caps are suitable for installing electronic circuit and plugged on to either side of common tube light 3A-3B. The end cap housing FIG 4A- 4B will be used to install LED driver circuit, switching sensors, dimming, battery power for backup or any other circuit wall mounting configuration, according to an exemplary embodiment of the present disclosures. The front and isometric views of a light emitting diode (LED) driver housing includes an inbuilt light emitting diode (LED) driver housing 402a and 402b, end cap 404a, G13 female sockets 406c and 406d, a protruded knob 408, fixing screws 408a and 408b, metal brackets 410, a cavity bracket 424, an aluminum rod 426, locking screw 428 and a driver PCB 436. The driver PCB 436 used to drive LEDs in an efficient and reliable manner.

[065] Referring to FIG. 4C and FIG. 4D are diagrams 400C and 400d depicting exploded and assembled views of a detachable driver housing and end caps suitable for wall mounting and hanging configuration, according to an exemplary embodiment of the present disclosures. The second design driver embodiment 400c and 400d includes a light emitting diode (LED) tube light enclosure with polycarbonate (PC) diffuser 412, an aluminum heat sink 412a, a wall mounting 414, a first end 416, a second end 418, FR4 printed circuit board (PCB) 420 and a light-emitting diode surface-mount-device (LED SMD) 422, a cavity bracket 424, an aluminum rod 426, locking screws 428 (as shown in Fig 4A), a conduit 430, input power supply 432, power supply wire connection 434 and a driver PCB 436. The detachable light emitting diode (LED) driver housing 402a and 402b with G13 female socket 406c and 406d are plugged into the first end 416 G13 male pins 406a and 406b and the second end 418 of the light emitting diode (LED) tube light enclosure.

[066] As shown in FIG. 4C and FIG. 4D, the light emitting diode (LED) tube light enclosure with polycarbonate (PC) diffuser 412 further comprising the aluminum heat sink 412a. The aluminum heat sink 412a is connected with end cap 404c and 404d are fixed with the fixing screws 408a and 408b. The light emitting diode (LED) tube light enclosure with polycarbonate (PC) diffuser 412 houses the FR4 grade printed circuit board (PCB) 420 and the light-emitting diode surface-mount-device (LED SMD) 422. The FR4grade printed circuit board (PCB) 420 and LED driver are separated, the LED driver is housed in detachable light emitting diode (LED) driver housing 402a and 402b to prevent the transfer of heat generated to the light-emitting diode surface-mount-device (LED SMD) 422. The driver end caps 404a and 404b can be used to open and close the detachable light emitting diode (LED) driver housing 402a and 402b in case of faults.

[067] As shown in FIG. 4C and FIG. 4D, the light emitting diode (LED) driver housing 402a and 402b and the shape of wall mounting 414 uses fixing screws 428(As shown in FIG. 4A)and a slot424 in the bottom side for wall mounting. The protruded knob 408 prevents reverse connection and the driver housing end caps 404a and 404b comprises a provision for the fixing screws 408a and 408b (As shown in FIG. 4B) to the driver 402a and 402b.

[068] As shown in FIG. 4C and FIG. 4D, the second design driver embodiment 400c and 400d secured to the driver end caps 404a, 404b and inner end caps 404c and 404d and fixed to the light emitting diode (LED) tube light with the G13 pins 406a and 406b for converting into to wall mounting 414 and hanging configuration (as shown in FIG. 4D). The cavity bracket 424 in the bottom side of the driver end caps 404a, 404b and driver housing 402a and 402b is used for wall mounting. The aluminum rod 426 penetrates through the cavity bracket 424 at the both ends of the light emitting diode (LED) driver housing 402a and 402b and locked with metal brackets (410) ensures and makes the LED tube light anti – theft.

[069] As shown in FIG. 4C and FIG. 4D, the aluminum heat sink 412a further comprises a conduit 430 at the back side of the tube light lamp. The power supply wire 434 through the power supply wire hole from the driver housing 402a is passed through inner end cap 404c to the conduit 430 in the aluminum heat sink 412a in a concealed manner from normal vision to improve aesthetics and protect the wire. Further the in-built system for concealed wiring used to supply input power 432at the center of the tube, makes the power connection simple and unique.

[070] Referring to FIG. 4E and FIG. 4F are diagrams 400e and 400f depicting exploded and assembled views of a low cost accessory to convert retrofit LED tube light with detachable driver in to wall mounting and hanging type by using the plastic end cap fixtures, according to an exemplary embodiment of the present disclosures. The low cost plastic accessory 404a and 404b includes two slots 406e and 406f for holding LED tube light system to convert into wall mounting 414 and hanging fixtures (as shown in FIG. 4F).

[071] Although the present disclosure has been described in terms of certain preferred embodiments and illustrations thereof, other embodiments and modifications to preferred embodiments may be possible that are within the principles and spirit of the invention. The above descriptions and figures are therefore to be regarded as illustrative and not restrictive.

[072] Thus the scope of the present disclosure is defined by the appended claims and includes both combinations and sub combinations of the various features described herein above as well as variations and modifications thereof, which would occur to persons skilled in the art upon reading the foregoing description.

CLAIMS:

What is claimed is

1. A light emitting diode (LED) tube light system, comprising:

a first driver embodiment and a second driver embodiment, whereby the first driver embodiment secured to at least one end cap for retrofitting the light emitting diode (LED) tube light of a conventional fixture; and whereby the second driver embodiment secured to the end caps and fixed to the LED tube light with the plurality of G13 pins for converting into to wall mounting; and hanging configuration.

2. The system of claim 1, wherein the LED tube lights comprising inbuilt driver with atleast one of: sealed; and removable end caps by removing screws for repair.

3. The system of claim 1, wherein the end caps on the outside of the driver housing comprising protruded G13 pins to fit in to the LED tube light fixture.

4. The system of claim 1, wherein the LED tube light enclosure manufactured with the aluminum printed circuit board (PCB), the aluminum shell and insertion of the light emitting diode surface-mount-device (LED SMD).

5. The system of claim 1, wherein the LED tube light further comprising a dimming and an automatic sensor relay circuit switches.

6. A light emitting diode (LED) tube light system, comprising:

a light emitting diode (LED) tube body comprising a first end and a second end;

at least one of an end cap coupled to the first end and the second end of the(LED tube body;

a plurality of G13 pins protruded from the at least one of the end cap of the first end and the second end;

a plug-in type housing comprising a driver plugged in to the first end and the second end of the LED tube.

7. The system of claim 6, wherein the LED tube body is a transparent material.

8. A light emitting diode (LED) tube light system, comprising:

a FR4 grade printed circuit board (PCB); wherein which includes a plurality of surface-mounted-device (SMD) light-emitting diodes (LED); wherein a polycarbonate (PC) diffuser and atleast two end caps with G13 male pins; wherein the polycarbonate (PC) diffuser cover further comprising an aluminum heat sink; wherein the aluminum heat sink placed at the back side of the light emitting diode (LED) tube body; wherein the aluminum heat sink further comprising a conduit at the back side of the light emitting diode (LED) lamp.

9. A light emitting diode (LED) tube light system, comprising:

a detachable driver end cap housing; wherein which comprises atleast two G13 female socket, a wire hole and atleast two fixing screws; wherein and two fixing screws further coupled to the aluminum heat sink; wherein

a power supply wire passes through a wire hole from a driver housing; wherein the power cable or wire is passed through the conduit in the aluminum heat sink in a concealed manner from normal vision to improve aesthetics and protect the wire; wherein the detachable driver

end cap housing used for retrofitting and wall mounting: and hanging installations with built in common driver suitable for the common light emitting diode (LED) tube; the detachable driver housing end cap will also be used installing sensors, battery backup, dimming and automatic ambient light adjustment; wherein a low cost plastic accessory converts a retrofit LED Tube light system into wall mounting: and hanging fixtures.

10. The system of claim 9, wherein the LED tube light further comprising an in-built system for concealed wiring used to supply input power at the center of the tube and wall mounting tube light has an additional anti-theft feature.

11. The system of claim 9, wherein the low cost plastic accessory further includes atleast two slots for holding the LED tube light system.

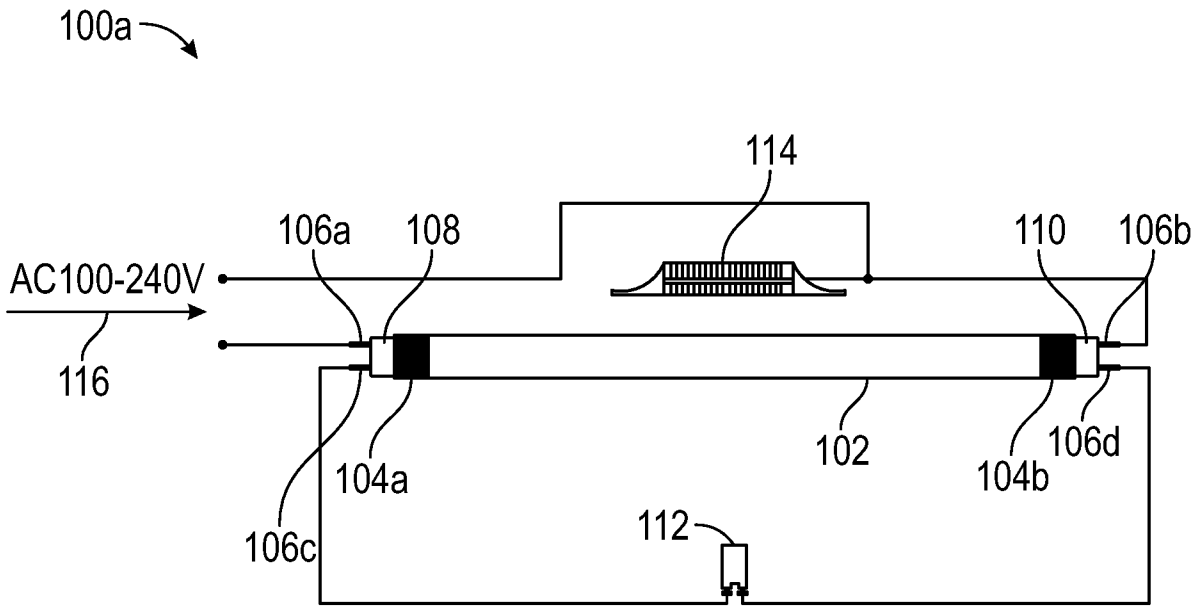


FIG. 1A
(Prior Art)

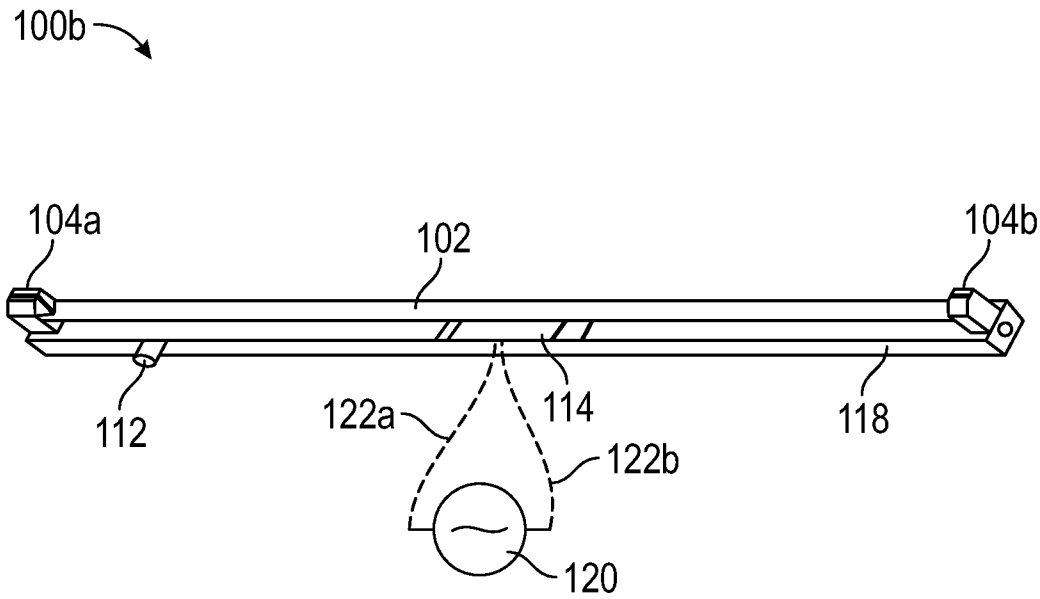


FIG. 1B
(Prior Art)

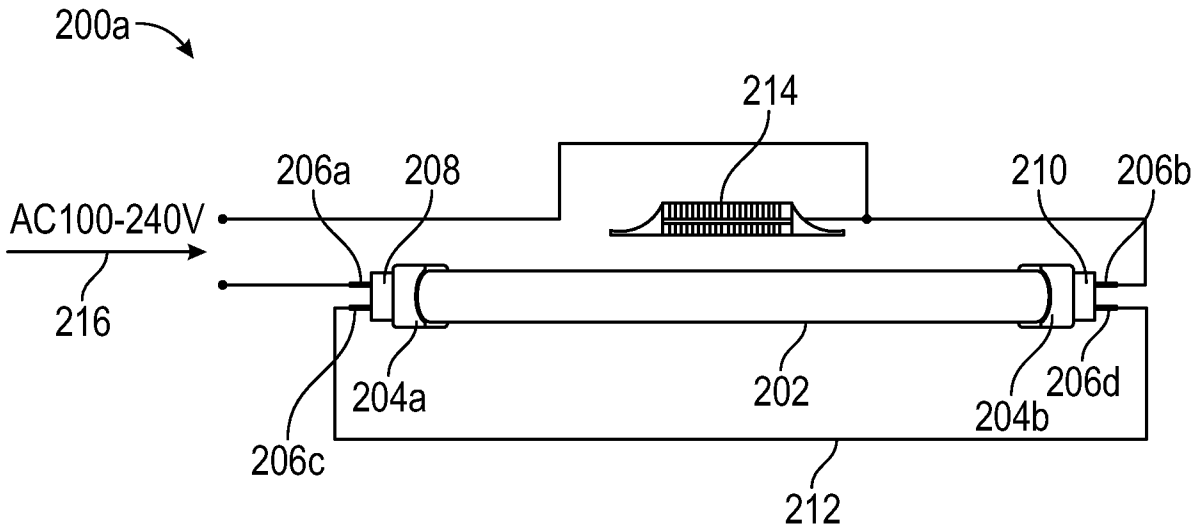


FIG. 2A
(Prior Art)

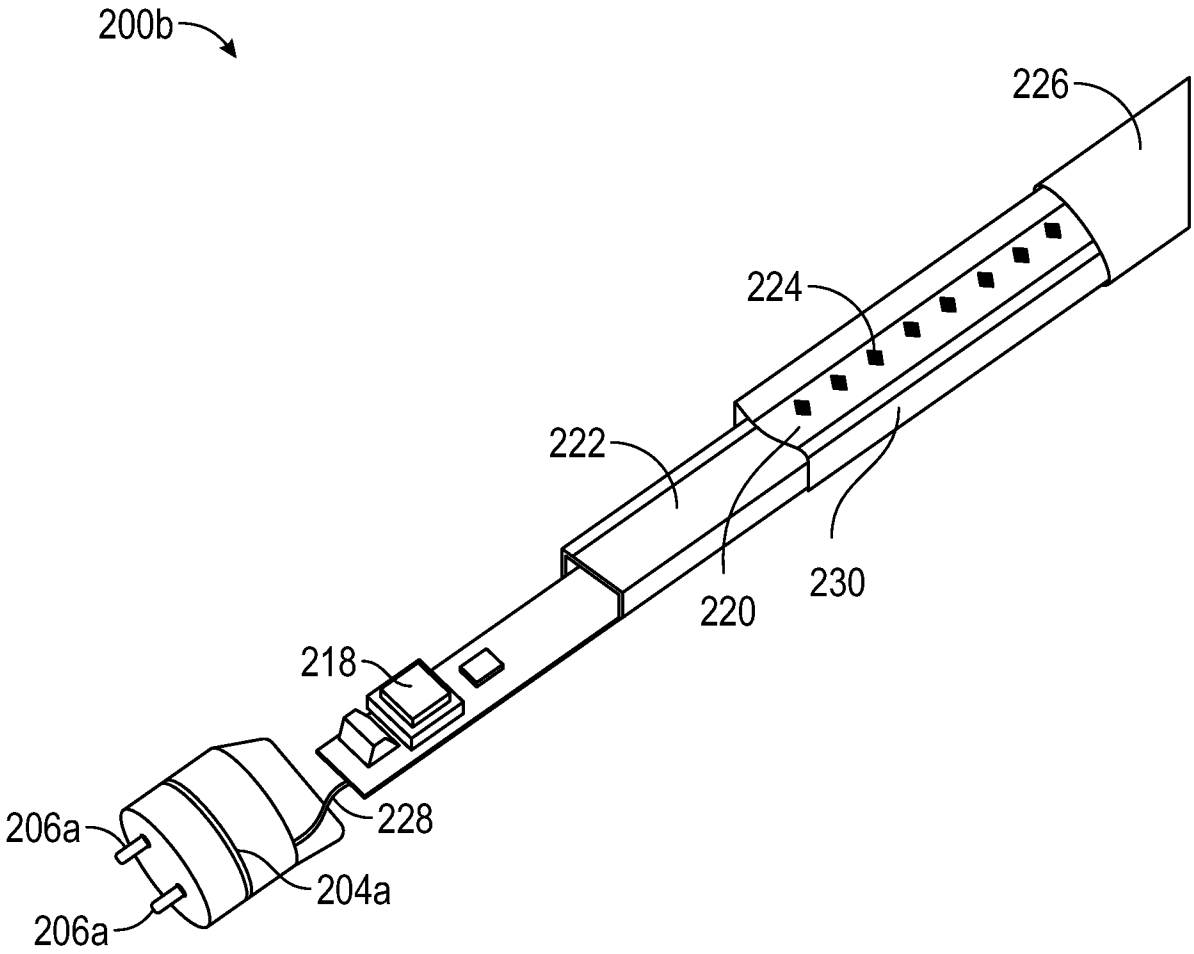


FIG. 2B
(Prior Art)

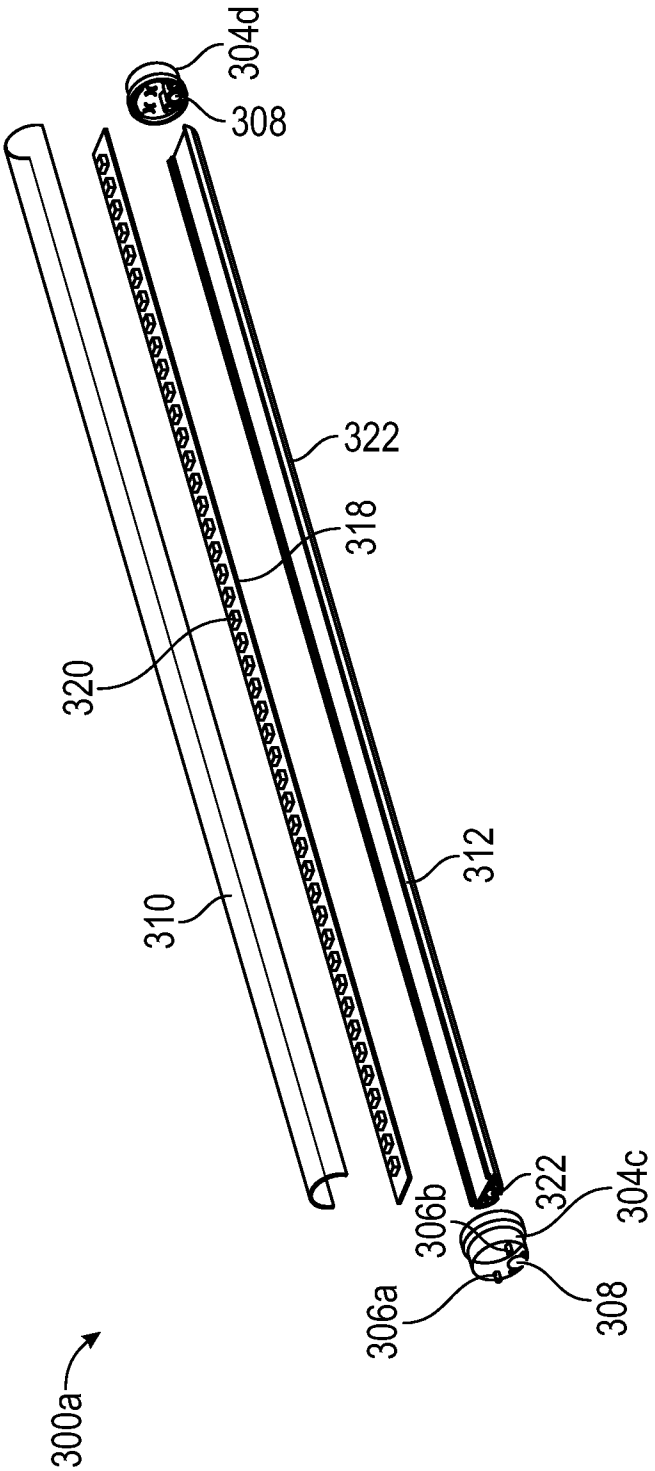
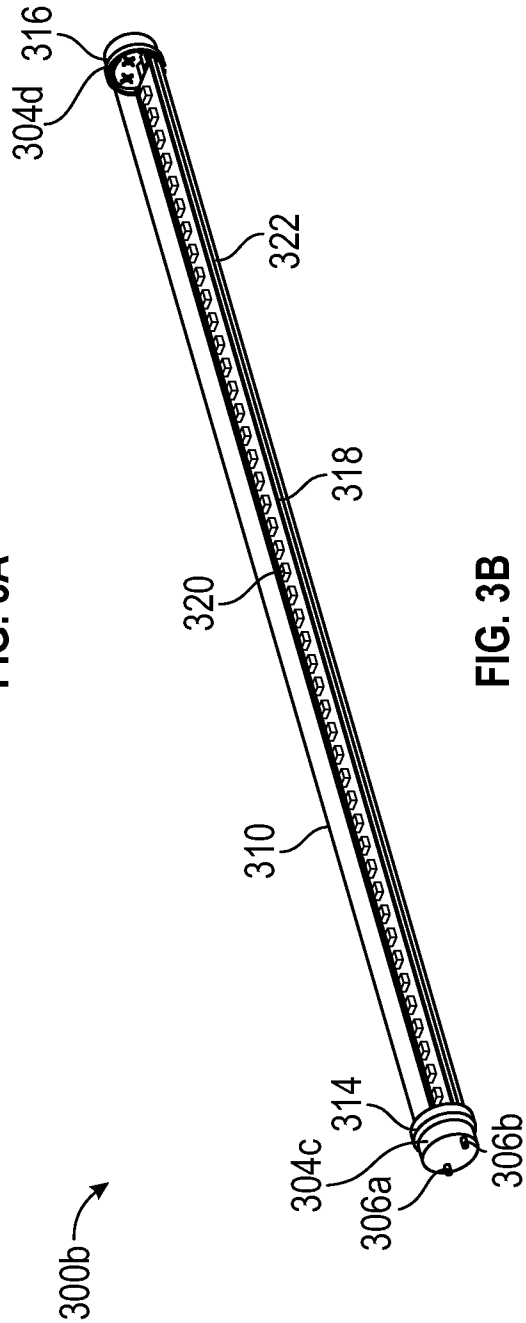

304d
308
322
318
320
312
310
306b
322
304c
306a
308
300a

FIG. 3A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318
320
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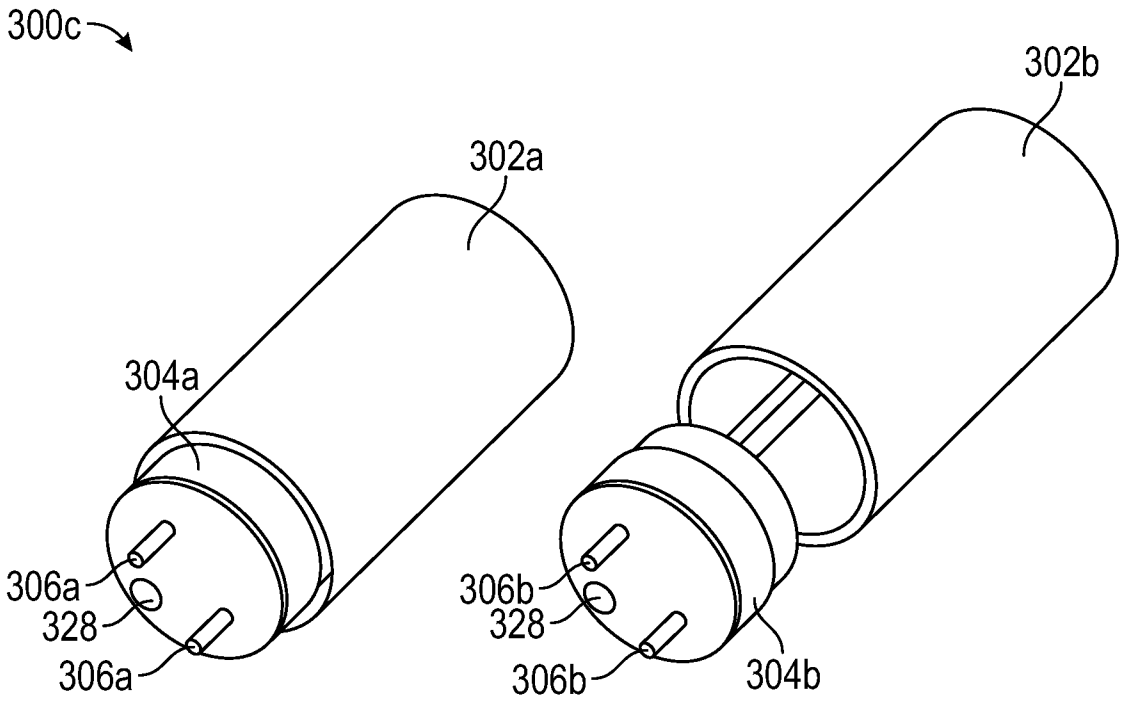
314
304c
306a
306b
300b

FIG. 3B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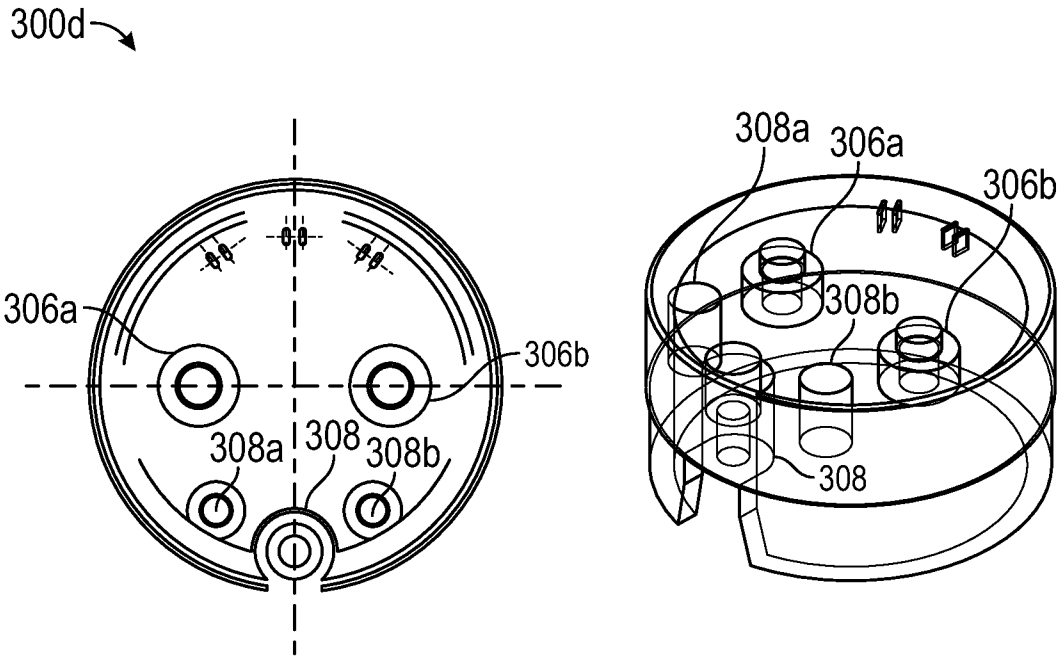
306a
306b
328
306b
304b

FIG. 3C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306b
308a
308
308b
308a
306a
306b
308b
308

FIG. 3D

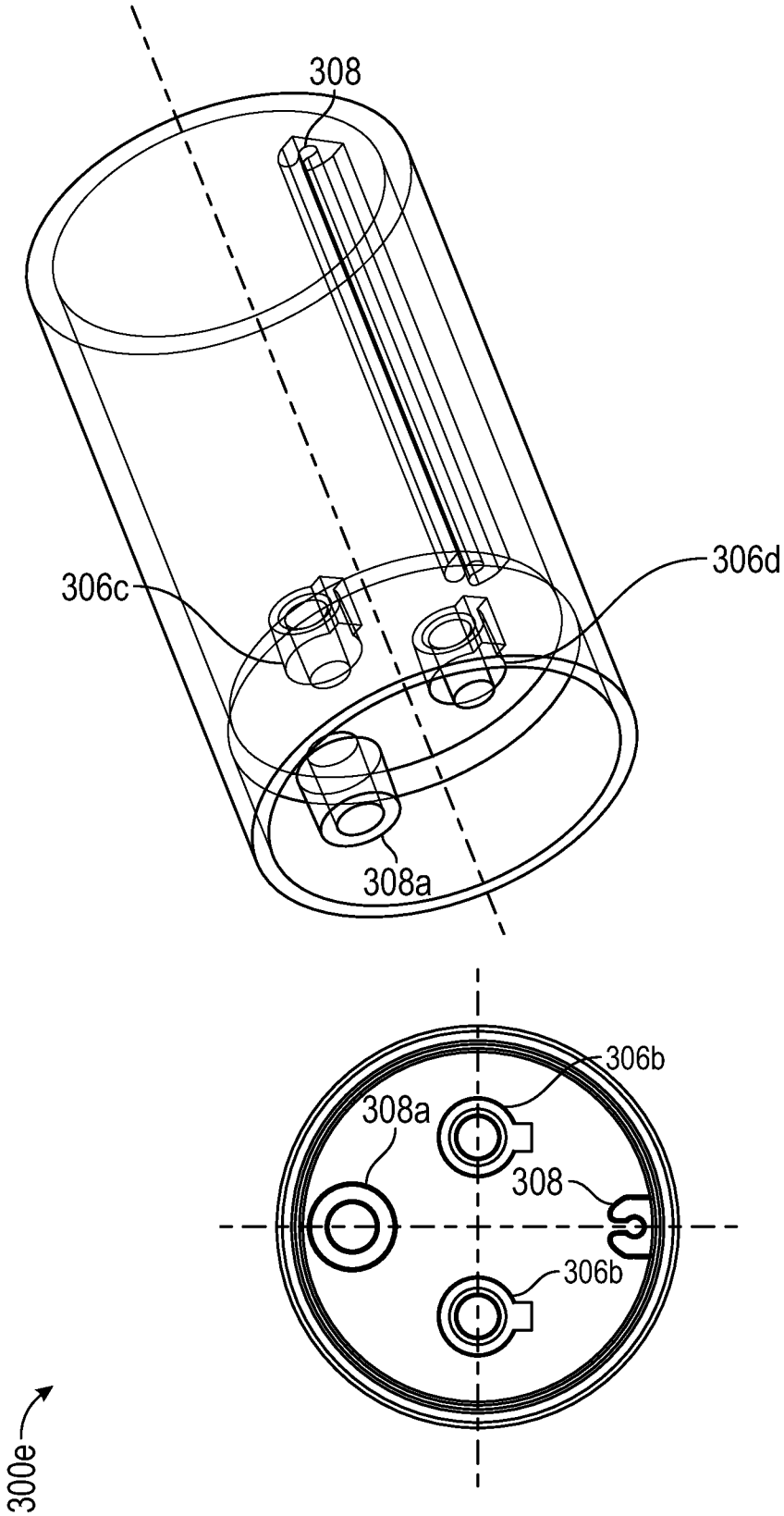


FIG. 3E

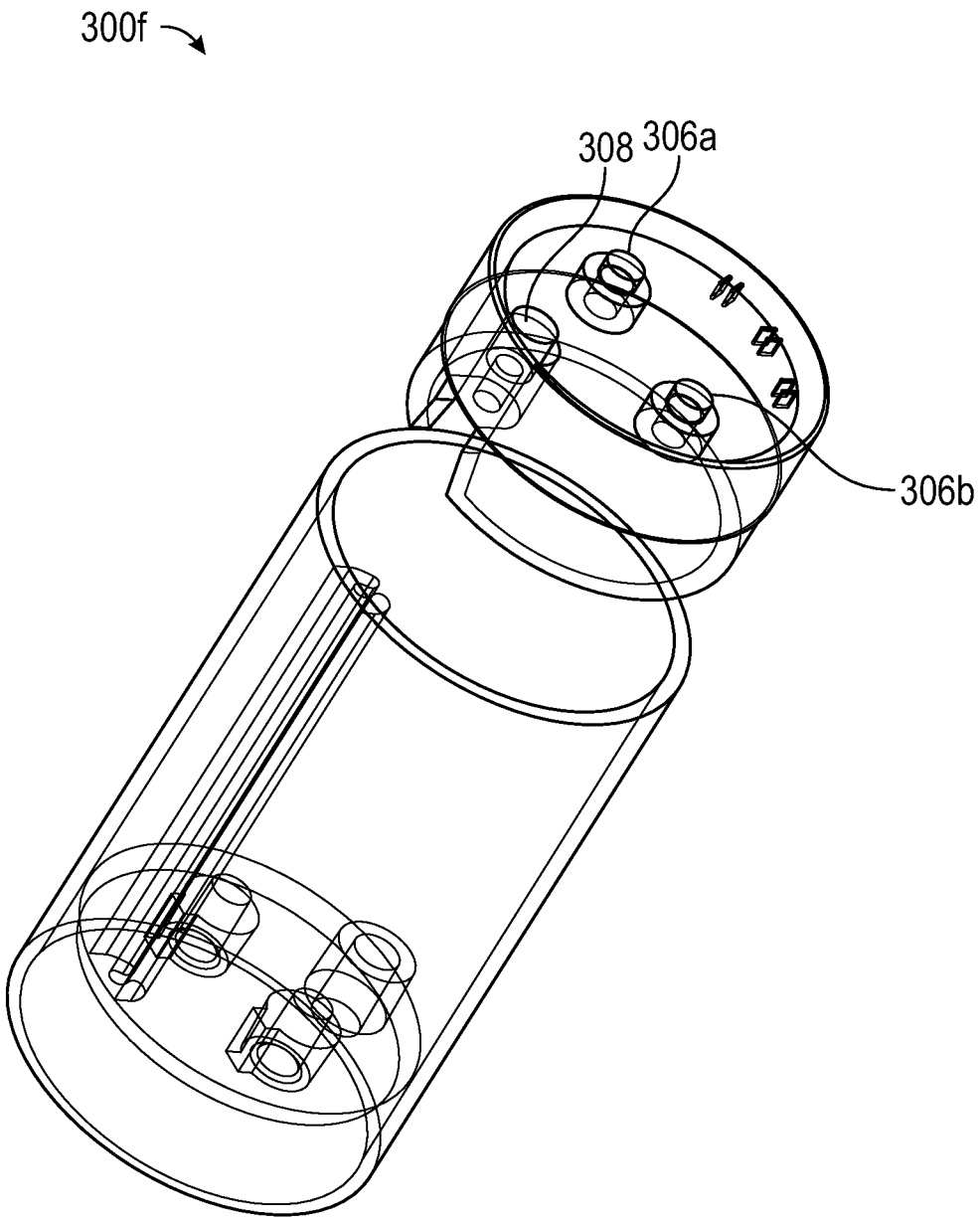
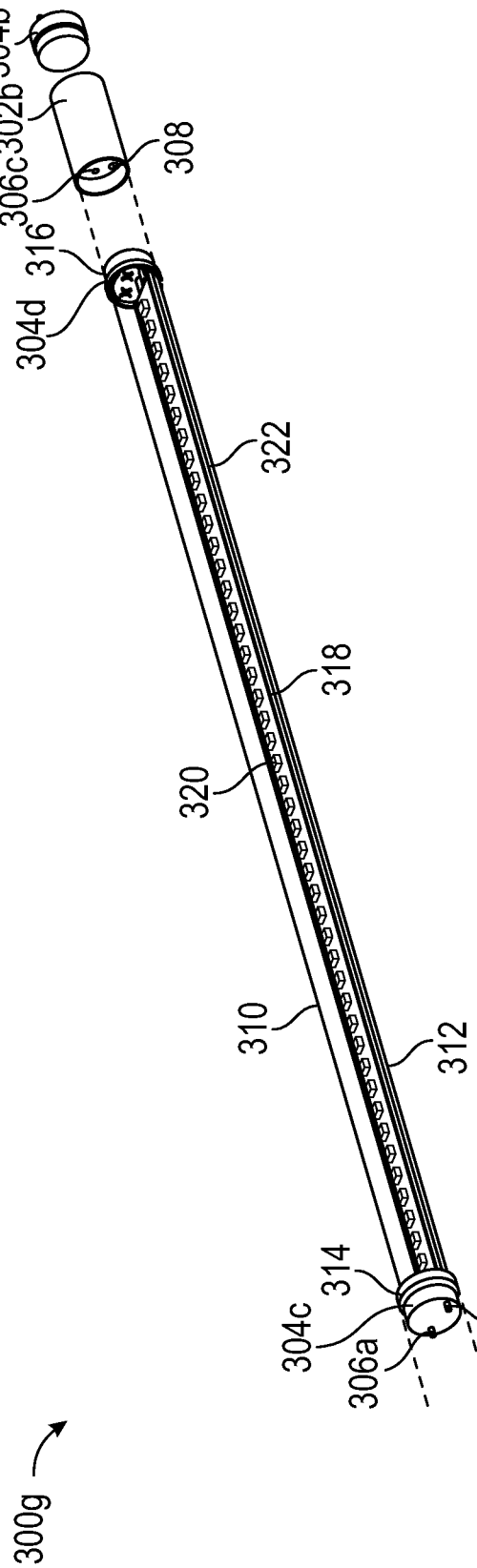


FIG. 3F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306c
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316
304d
322
318
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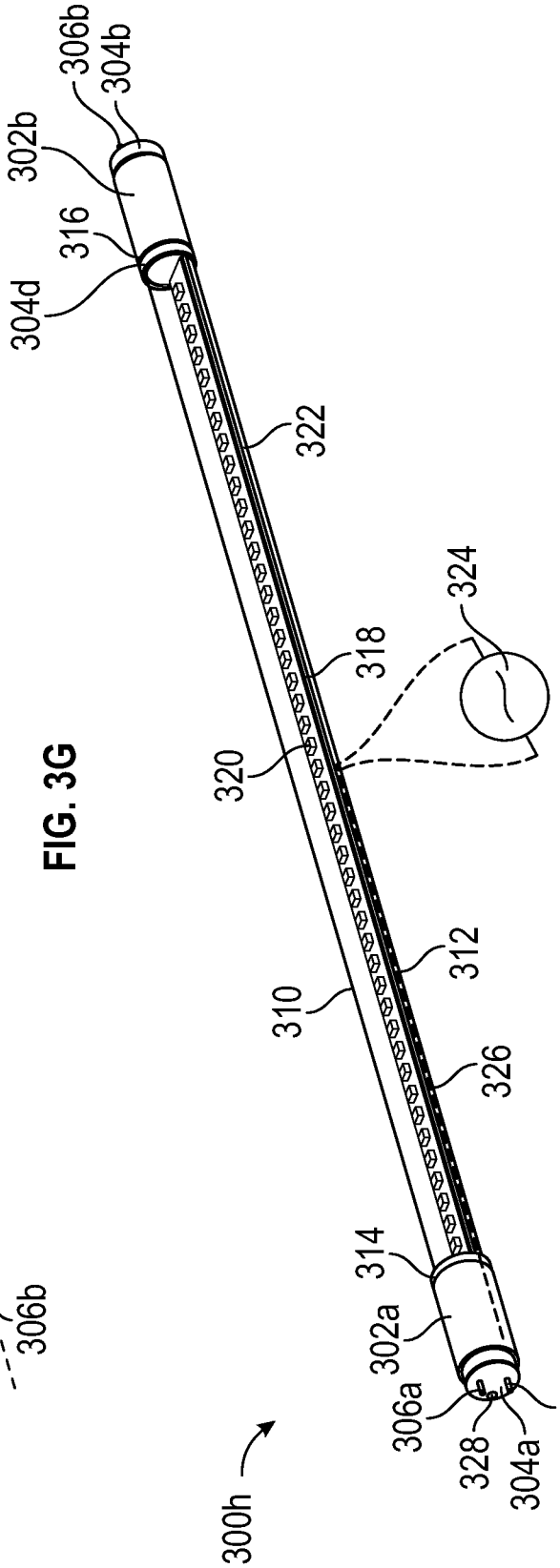
310
312
314
304c
306a
306b

FIG. 3G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306b
304b
302b
316
304d
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324
318
320
310
312
326
314
302a
306a
328
304a
306b

FIG. 3H

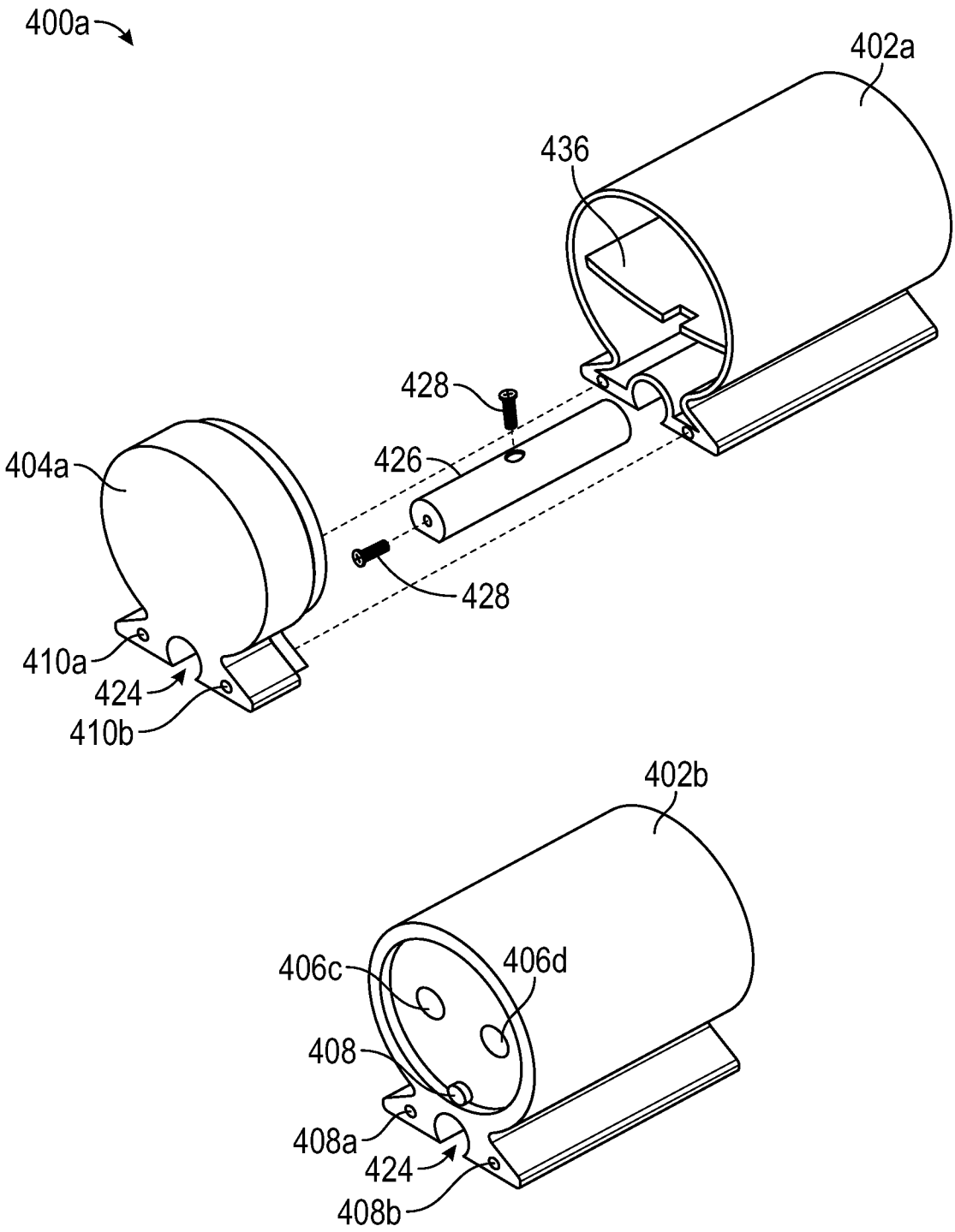

400a
402a
436
428
426
404a
428
410a
424
410b
402b
406c
406d
408
408a
424
408b

FIG. 4A

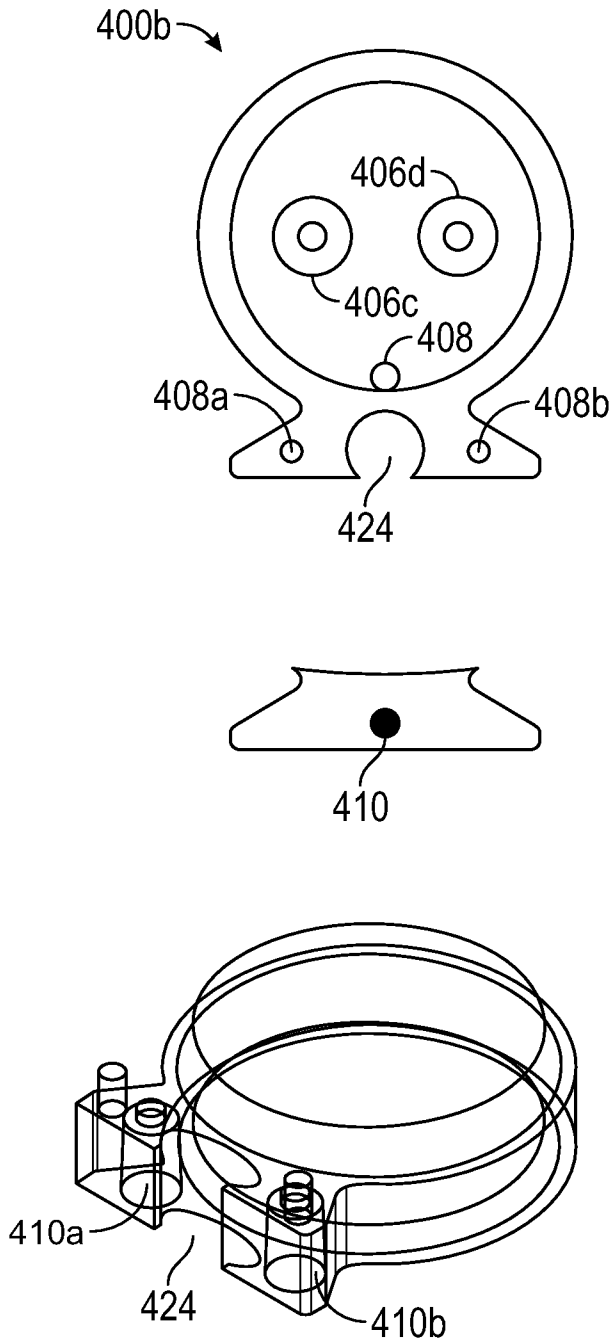
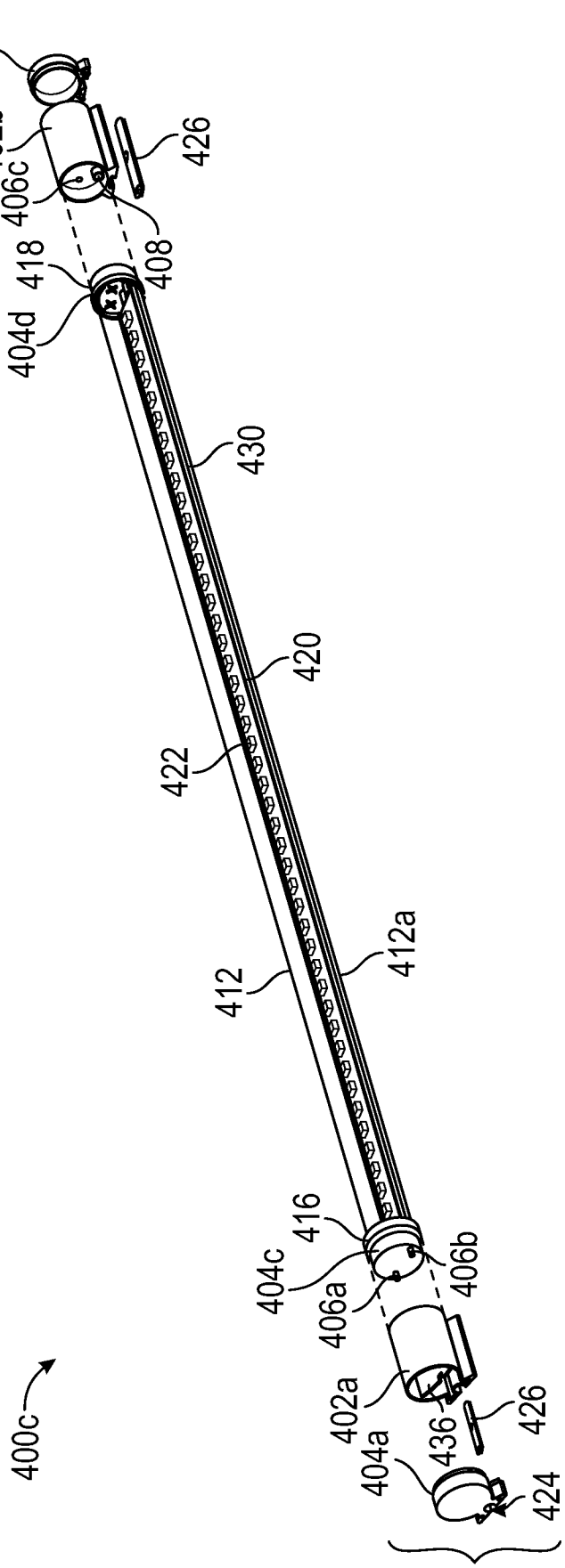


FIG. 4B


404b
402b
406c
426
418
408
404d
430
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422
412a
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404c
406a
406b
402a
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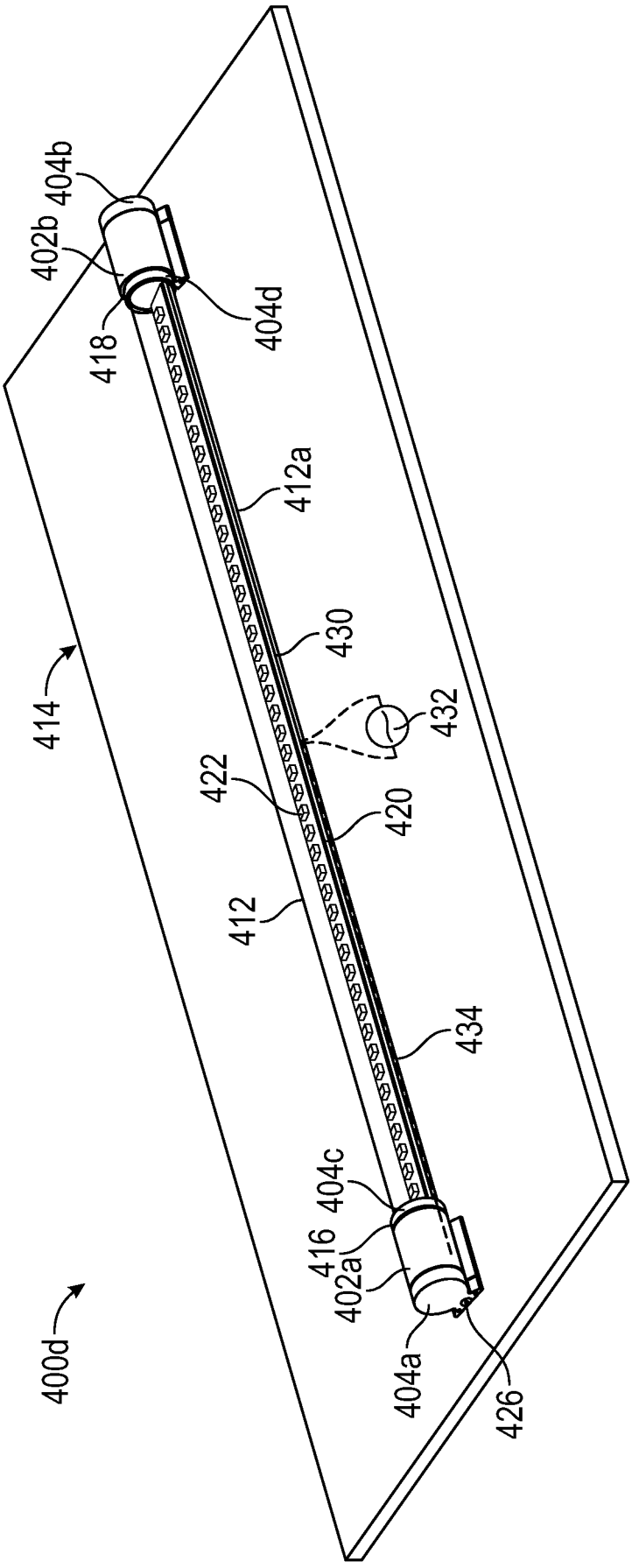
426
404a
424
400c

FIG. 4C


400d
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422
420
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404c
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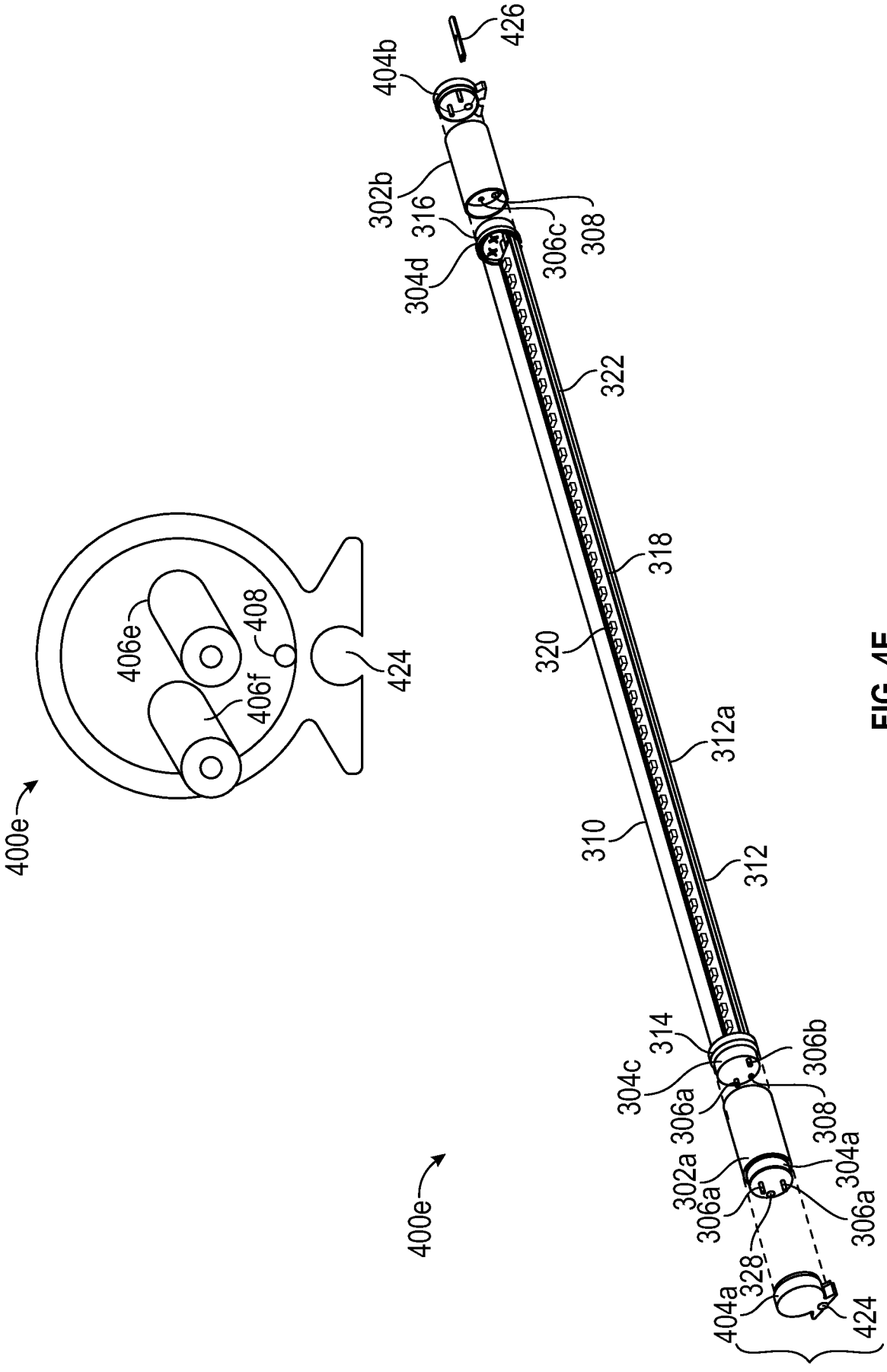
402a
404a
426

FIG. 4D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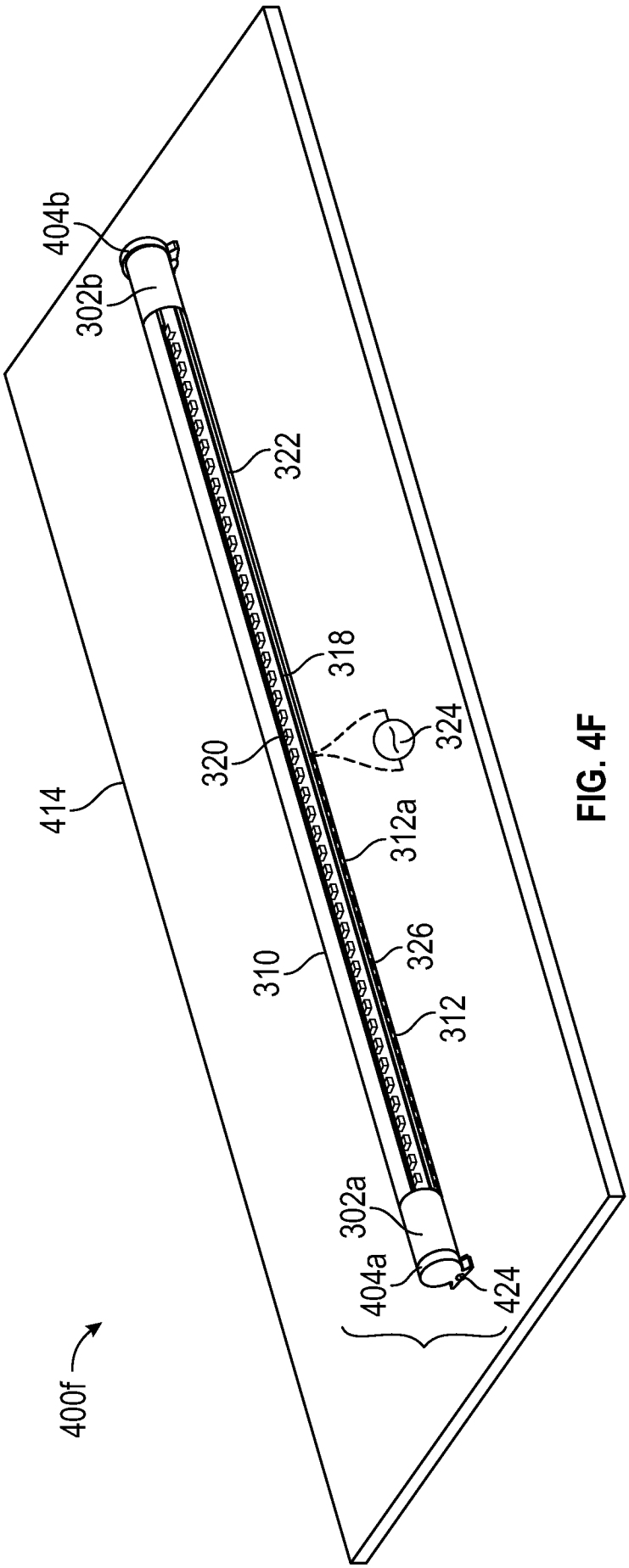
328
404a
424

FIG. 4E


404b
302b
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318
320
324
414
312a
326
310
312
302a
404a
424
400f

FIG. 4F

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2016/052292

A. CLASSIFICATION OF SUBJECT MATTER
F21K9/27,F21V23/003,F21V23/004 Version=2016.01

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F21K, F21V

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

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

Databases: Patseer, IPO Internal Database.
Keywords: LED, tube light, plug-in, driver, retrofitting.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US2007242466A1 (LEOTEK ELECTRONICS CORPORATION) 18 October 2007 (18/10/2007) abstract, paragraphs 0003-0010 and figures 3-4.	1-11
Y	US2007228999A1 (DENOVO LIGHTING LLC) 04 October 2007 (04/10/2007) paragraphs 0105-0125, figures 35-38, 60, and 61.	1-11
Y	US2013329434A1 (LEVEL SOLUTIONS LLC) 12 December 2013 (12/12/2013) paragraphs 0022-0046.	1-11

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29-08-2016	29-08-2016
Name and mailing address of the ISA/ Indian Patent Office Plot No.32, Sector 14,Dwarka,New Delhi-110075 Facsimile No.	Authorized officer Pradeep Kumar Telephone No. +91-1125300200

International application No.
PCT/IB2016/052292

Citation	Pub.Date	Family	Pub.Date
US 2007242466 A1	18-10-2007	WO 2007120501 A2	25-10-2007
US 2007228999 A1	04-10-2007	US 7507001 B2	24-03-2009
US 2013329434 A1	12-12-2013	US 2015131287 A1	14-05-2015