

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
23 February 2006 (23.02.2006)

PCT

(10) International Publication Number  
**WO 2006/020687 A1**

(51) International Patent Classification<sup>7</sup>: **F21L 14/02**

(21) International Application Number:  
PCT/US2005/028372

(22) International Filing Date: 10 August 2005 (10.08.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
10/914,805 10 August 2004 (10.08.2004) US  
10/915,527 10 August 2004 (10.08.2004) US

(71) Applicant (for all designated States except US): **ALERT SAFETY LITE PRODUCTS CO., INC.** [US/US]; 24500 Solon Road, Bedford Heights, OH 44146 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KOVACIK, James, D.** [US/US]; 4662 Wodbridge Lane, Brecksville, OH 44141 (US). **BLANCH, Paul, S.** [US/US]; 1230 Homestead Creek Drive, Broadview Heights, OH 44141 (US). **SMITH, Joseph, J.** [US/US]; 1624 Rathburn Road, Wooster, OH 44691 (US).

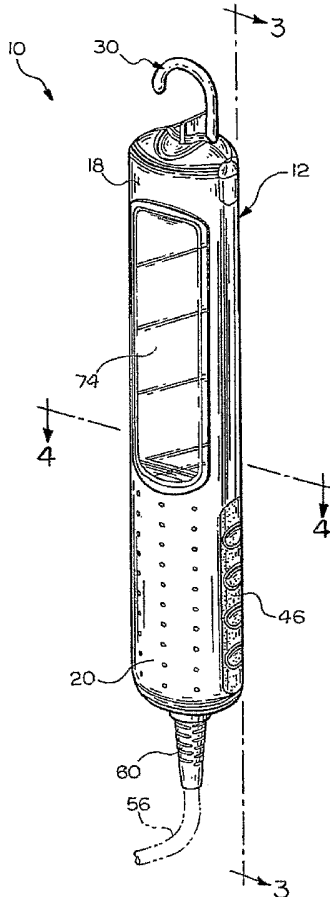
(74) Agent: **CLEMENS, William, J.**; Butzel Long, Suite 200, 100 Bloomfield Hills Parkway, Bloomfield Hills, MI 48304 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,

[Continued on next page]

(54) Title: LED UTILITY LIGHT



(57) Abstract: An LED utility light (10, 210, 410, 610) has a hollow housing (12, 212, 412, 612) enclosing an LED array assembly (70, 282, 476, 680) and a reflector member (72, 284, 480, 684) behind a lens (74, 286, 482, 684). The LEDs are lighted by electrical power from a converter (80, 690) or a battery (270, 470) and can be selectively operated to light some or all of the LEDs in the array. The utility light can be positioned using a hook (30, 240, 440, 640) or a magnet assembly (716). Handle cushions (46, 260, 462, 656) and an upper cushion (647) are attached to the utility light.



WO 2006/020687 A1



RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**Published:**

— *with international search report*

TITLE

## LED UTILITY LIGHT

BACKGROUND OF THE INVENTION

5           The present invention relates generally to illumination devices and, in particular, to an LED utility light.

          Portable lights, which can be manually moved and suspended about a work site to aid a user to obtain the best lighting conditions, are well known. It has been the practice to use incandescent light bulbs, suitably encased in light guards, for this purpose. Such lights  
10 are often referred to as trouble lamps, extension lights, work lights, inspection lights, utility lights, and the like, and are commonly employed by mechanics and other workers who require a concentration of light while frequently changing locations. Such a trouble light is shown in the U.S. Patent No. 4,774,647 issued to Kovacik et al.

          Fluorescent lights have several advantages in use as compared with the  
15 incandescent bulbs. As an example, for the same wattage fluorescent lights usually provide more light with less glare. In the past, attempts have been made to convert portable lights such as extension lights to fluorescent tubes. For example, see the U.S. Patent No. 5,921,658 issued to Kovacik et al.

          Light emitting diodes (LEDs) are well known for providing illumination to digital  
20 displays and the like. It has become more common for a concentration of LEDs to be utilized for providing illumination. LEDs are particularly advantageous because of their low power consumption per candlepower produced when compared to incandescent light bulbs and, to a lesser degree, to fluorescent light bulbs.

          The art continues to seek improvements. It is desirable to provide a portable light  
25 having lower power consumption that also provides sufficient illumination for a work site. It is also desirable to be able to place and orient the portable light in as many locations and positions as possible. It is often desirable to provide a utility light that does not always require the use of an external power supply cord. It is always desirable to provide utility lamps that are lightweight and cost-effective to produce.

### SUMMARY OF THE INVENTION

The present invention concerns an LED utility light including: a hollow housing having an upper light portion and a lower handle portion, the light portion having a lens aperture formed therein; an LED circuit board assembly disposed in the housing, the circuit board assembly including a plurality of LEDs arranged in a predetermined array and facing the lens opening; a reflector member mounted between the circuit board assembly and the lens opening, the reflector member having a plurality of light apertures formed therein corresponding to the array with each of the LEDs being visible through an associated one of the light apertures; and a lens member mounted in the lens opening for passing light generated by the LEDs.

The utility light includes a pair of upper cushions mounted on the light portion and a pair of handle cushions mounted on the handle portion. Each of the cushions has at least one attachment finger engaging a cutout in the housing.

The utility light includes a hook member rotatably attached to the housing for hanging and positioning the utility light.

The LEDs can be arranged in rows of three LEDs each and arrays of thirty LEDs and sixty LEDs are shown and described below. The light apertures are cone shaped and the reflector member has a reflective front surface.

An alternative embodiment of the present invention concerns a portable utility light including: a hollow housing having a lens opening formed therein; a plurality of LEDs disposed in the hollow housing adjacent the lens opening; a reflector member disposed in the housing and having a plurality of apertures of cone-shaped profile formed therein, each of the apertures receiving an associated one of the LEDs; and a transparent lens member mounted in the lens opening permitting light generated from the LEDs to exit the housing. The housing is formed by a front housing half releasably attached to a rear housing half and is generally arcuate in a horizontal plane.

The LEDs are mounted on a circuit board in rows and columns. The reflector member has a reflective surface facing the lens member. The light includes a battery disposed in the housing and connected to the LEDs by a switch. An electrical plug is mounted to the housing and connected to the battery for connection to an external power source to recharge the battery. The battery is a DC battery and a transformer means is connected to the battery for recharging.

A hook member is disposed in a recess formed in an exterior surface of the housing and is rotatable between a stored position in the recess and an extended position. The hook member is attached to the housing by a ball and socket connection permitting the hook member to rotate about a longitudinal axis of the hook member.

5 A lanyard can be attached to the housing. A pair of handle cushions is attached to opposite sides of the housing. A carrying case is provided for receiving and retaining the light.

The lens member has a plurality of focusing portions formed thereon facing the LEDs for focusing light generated by said LEDs. In the alternative, the lens member can  
10 be flat or have concave portions for generating a flood light effect.

Another alternative embodiment of the present invention concerns a portable rechargeable utility light including an elongated front housing portion having a lens opening formed therein, a rear housing portion having a hook recess and a switch aperture formed therein, the rear housing portion being attached to the front housing  
15 portion to form a hollow light housing, and a pair of handle cushions attached to the light housing. A rechargeable battery is mounted in the housing and is selectively connected to a plurality of LEDs mounted in the housing adjacent the lens opening by a switch mounted in the switch aperture.

A hook member is attached to the housing for movement between a stored  
20 position in the hook recess and a use position out of the hook recess. A reflector member is mounted in the housing and has a plurality of apertures formed therein, each of the apertures receiving an associated one of the LEDs. A transparent lens member mounted in the lens opening permits light generated by said LEDs to exit the housing. A pair of electrical contacts is mounted on the housing and is connected to the battery. A charging  
25 base for releasably retaining the light housing provides electrical power through the electrical contacts to recharge the battery. A low battery detector is connected to the battery, an indicator aperture is formed in the front housing portion and a low battery indicator is mounted in the indicator aperture and is connected to the low battery detector for visually indicating a low battery condition of the battery.

30 The switch can have a first "on" position for connecting a first group of the LEDs to the battery, the first group being less than all of the LEDs, and at least a second "on"

position for connecting a second group of the LEDs to the battery, the second group including at least all of the LEDs not included in the first group.

The LEDs are mounted on a circuit board in rows and columns. The reflector member has a reflective surface facing the lens member. The lens member has a plurality of focusing portions formed thereon facing the LEDs for focusing light generated by the LEDs. In the alternative, the lens member can be flat or have concave portions for generating a flood light effect.

Yet another alternative embodiment of the present invention concerns an LED utility light including: a hollow housing having a wider upper light portion connected to a narrower lower handle portion, the light portion having a lens opening formed therein; a plurality of LEDs mounted in the housing adjacent the lens opening; a transparent lens member mounted in the lens opening permitting light generated from the LEDs to exit the housing; and a magnet assembly mounted on the housing and adapted to releasably retain the utility light on a support surface. A magnet of the magnet assembly is releasably attached to the housing and can be rotated about an axis generally parallel to the longitudinal axis of the housing. The narrower handle portion allows for easier manipulation of the utility light by a single human hand when in use.

The LEDs are mounted on a circuit board in rows and columns. A reflector has a reflective surface facing the lens and apertures for each of the LEDs. A hook member is disposed in a recess formed in an exterior surface of the housing and is rotatable between a stored position in the recess and an extended position. The hook member is attached to the housing by a ball and socket connection permitting the hook member to rotate about a longitudinal axis of the hook member. An electrical plug is disposed in the rear housing half at a preferably canted position with respect to the longitudinal axis of the rear housing half in a receiver portion formed in the rear housing half.

The LED utility light in accordance with the present invention advantageously provides a portable handheld utility light that may be placed and oriented in many locations and positions with the use of the hook member and the removable magnet assembly and, alternatively, provides a portable handheld utility light that does not need to be connected constantly to an external power supply.

### DESCRIPTION OF THE DRAWINGS

The above, as well as other advantages of the present invention, will become readily apparent to those skilled in the art from the following detailed description of a preferred embodiment when considered in the light of the accompanying drawings in  
5 which:

Fig. 1 is a perspective view of an LED utility light in accordance with the present invention;

Fig. 2 is an exploded perspective view of the LED utility light of Fig. 1;

Fig. 3 is a cross-sectional view taken along line 3-3 in Fig. 1;

10 Fig. 4 is a cross-sectional view taken along line 4-4 in Fig. 1;

Fig. 5 is an electrical schematic of an LED utility light in accordance with the present invention;

Fig. 6 is an exploded perspective view of an alternative embodiment of an LED utility light in accordance with the present invention;

15 Fig. 7 is a perspective view of an alternative embodiment of an LED utility light in accordance with the present invention;

Fig. 8 is an exploded perspective view of the utility light shown in Fig. 7;

Fig. 9 is a perspective view of the rear housing half shown in Fig. 8;

Fig. 10 is a perspective view of the battery retainer shown in Fig. 8;

20 Fig. 11 is a front elevation view of the utility light shown in Fig. 7;

Fig. 12 is a cross-sectional view taken along the line 12-12 in Fig. 11;

Fig. 13 is a cross-sectional view taken along the line 13-13 in Fig. 11;

Fig. 14 is an electrical schematic of the utility light shown in Fig. 7;

25 Fig. 15 is a front elevation view of an alternative embodiment of an LED utility light in accordance with the present invention;

Fig. 16a is an exploded perspective view of the LED utility light of Fig. 15 and Fig. 16b is an enlarged fragmentary perspective view of the front housing portion shown in Fig. 16a;

30 Figs. 17a and 17b are perspective views of the interior of the rear housing portions of the utility light shown in Fig. 15;

Fig. 18 is a cross-sectional view taken along line 18-18 in Fig. 15;

Fig. 19 is a cross-sectional view taken along line 19-19 in Fig. 15;

Fig. 20 is a perspective view of the utility light of Fig. 15 shown docked in a charging base; and

Fig. 21 is an electrical schematic of the utility light shown in Fig. 15;

Fig. 22 is a rear elevation view of an alternative embodiment of an LED utility light in accordance with the present invention;

Fig. 23 is a side elevation view of the utility light of Fig. 22;

Fig. 24 is an exploded perspective view of the utility light of Fig. 22;

Fig. 25 is a perspective view of the interior of the front housing portion of the utility light shown in Fig. 22;

Fig. 26 is a cross-sectional view taken along line 26-26 in Fig. 22;

Fig. 27 is a cross-sectional view taken along line 27-27 in Fig. 22; and

Fig. 28 is an electrical schematic of the utility light shown in Fig. 22.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to Figs. 1-4, an LED utility light in accordance with the present invention is indicated generally at **10**. The utility light **10** includes a hollow light housing **12** split on a vertical plane into a rear housing shell **14** and a front housing shell **16**. When attached, the housing shells **14** and **16** define an elongated upper light portion **18** extending from a lower handle portion **20**. The housing shells **14** and **16** are substantially arcuate in cross section and, when attached, form the housing **12** with a substantially oval cross section. The housing **12** is preferably formed of a lightweight material, such as plastic or the like, as the utility light **10** is contemplated to be both handheld and portable. The rear housing shell **14** includes a plurality of strengthening ribs **22** (Fig. 2) extending generally horizontally across interior walls thereof. A plurality of tubular bosses **24** extend from an inner surface **26** of the rear housing shell **14** for receiving respective fasteners (not shown) inserted into corresponding apertures (not shown) formed in the shell **14**. The fasteners extend through the bosses **24** into corresponding posts **25** that extend from an inner surface **27** of the front housing shell **16** to secure the shells **14** and **16** together to form the housing **12**, discussed in more detail below.

An upper portion of the each of the housing shells **14** and **16** is formed to define a recess or cavity **28** for receiving a disk portion **32** of a hook member **30**. The disk portion **32** is trapped between a top wall **19** and an interior wall **23** of the shells **14** and **16** defining

the recess **28**. After the shells **14** and **16** are joined, a shank portion **31** of the hook **30** extends upwardly from the disk portion **32** through an aperture formed in the top wall **19** and a post **33** extends downwardly from the disk portion **32** through an aperture formed in the interior wall **23** allowing the hook **30** to rotate freely about a longitudinal axis of the utility light **10** as shown by an arrow **34** in Fig. 2. The hook member **30**, therefore, provides a means for hanging and orienting the utility light **10** during use.

Each one of a pair of upper cushions **36** includes a plurality of attachment fingers **38** having a stop portion **40** and a shaft portion **42**. The upper cushions **36** are each attached to the light portion **18** of the housing **12** by placing the shaft portion **42** of the attachment fingers **38** in corresponding grooves or cutouts **44** formed in facing side edges of the rear shell **14** and the front shell **16** of the housing **12**. The stop portions **40** prevent removal of the cushions **36** from the housing **12** after the housing **12** has been assembled, as discussed in more detail below. Similarly, each one of a pair of elongated handle cushions **46** includes a plurality of attachment fingers **48** having a stop portion **50** and a shaft portion **52**. The handle cushions **46** are each attached to the handle portion **20** of the housing **12** by placing the shaft portion **52** of the attachment fingers **48** in corresponding grooves or cutouts **54** formed in facing side edges of the rear shell **14** and the front shell **16** of the housing **12**. The stop portions **50** prevent removal of the cushions **46** from the housing **12** after the housing **12** has been assembled. The upper cushions **36** and the handle cushions **46** are each preferably constructed of a soft, easily deflectable material.

A power cord **56** extends through an aperture **58** in a bottom wall **21** of the handle portion **20** and is used to provide power to the circuitry, discussed below, that is enclosed within the housing **12**. A split member strain relief means **60** is attached to the power cord **56**. The diameter of the strain relief means **60** gradually tapers outwardly to a pair of spaced radial projections **62** that overlap an edge **64** of the bottom wall **21** defining the aperture **58** to retain the power cord **56** in place should a pulling force be applied to the power cord **56**. The projections **62** absorb any forces so that the electrical connections with the circuitry may be maintained. The end of the power cord **56** has a male plug (not shown) for insertion into a common female electrical power receptacle (not shown) to obtain AC power.

The hollow housing **12** defines a space between the rear shell **14** and the front shell **16** thereof for receiving a plurality of lighting components, including an LED circuit board

assembly 70, a reflector member 72, a lens member 74, and a switch 76. The switch 76 is disposed in an aperture 78 formed in the rear shell 14 of the housing 12 and electrically connects power from a power source (not shown) connected to the power cord 56 to an inlet of a conventional AC/DC power converter 80 or the like on the LED circuit board assembly 70. The LED circuit board assembly 70 includes a plurality of LEDs 82 extending from a front surface 84 thereof. In the example shown, thirty LEDs 82 are arranged in an array having ten rows of three LEDs each. The LEDs 82 are connected in parallel to an output of the converter 80 and are operable to emit light in a well-known manner when a DC voltage is provided by the converter.

10 The reflector member 72 is in the form of a planar mask that fits over the front surface 84 of the LED circuit board assembly 70. The reflector member 72 includes a plurality of spaced apart apertures 86 formed therein. A front surface 87 of the reflector member 72 is preferably mirror chrome plated or has a similar highly reflective surface. The number and spacing of the apertures 86 corresponds to the number of the LEDs 82 on the circuit board assembly 70. The walls of the reflector member 72 that define each of the apertures 86 are also mirror chrome plated and taper radially outwardly from the adjacent front surface 84 to the front surface 87 to form a generally cone-shape profile, best seen in Figs. 3 and 4. A width, indicated by an arrow 88, of the reflector member 72 is greater than a width, indicated by an arrow 90, of the circuit board assembly 70. A plurality of spaced support legs 92 extend from a rear surface of the reflector member 72 along side edges thereof. The spacing between the support legs 92 at opposed sides of the reflector member 72 is greater than the width 90 of the circuit board assembly 70 so that the support legs 92 extend beyond the side edges of the circuit board assembly 70 and engage with corresponding support pins 94 extending upwardly from outer edges of the support ribs 22 of the rear housing shell 14. A pair of brackets 96 extends from upper and lower ends respectively of the reflector member 72. Each of the brackets 96 is arched away from the front surface 87 and has opposite ends attached at opposite sides of the reflector member 72, best seen in Figs. 2 and 3.

The lens member 74 is received in an aperture 98 extending through an upper portion of the front housing shell 16 during assembly of the utility light 10. The lens member 74 is preferably constructed of clear plastic material or similar material. The lens member 74 includes a surrounding flange 100 that is trapped between the brackets 96 and a

periphery **102** of the front shell **16** (Fig. 3) surrounding the aperture **98**.

Referring to Fig. 4, the front housing shell **16** has a peripheral flange **104** on the outer edge that overlaps a cooperating peripheral flange **106** on the outer edge of the rear housing shell **14** when the shells are secured together by fasteners (not shown) extending through the bosses **24** engaged in corresponding posts **25**. The reflector **72** preferably includes a projection **108** extending from each side edge of the front surface **87** for cooperating with a corresponding groove **110** formed in a facing surface of the flange **100** of the lens member **74**. The cooperating projections **108** and grooves **110** assist in aligning the lens member **74** with the reflector **72**.

10 As seen in Figs. 3 and 4, the lens member **74** has a plurality of focusing portions **75** that correspond in number and position to the LEDs **82**. Each of the focusing portions **75** is formed as a convex protrusion on the rear surface of the lens member **74** facing the reflector member **72**. The focusing portions **75** collect and focus light from the corresponding LEDs **82** to generate a collective focused beam of light exiting the lens member **74**. However, the rear surface of the lens member **74** could be flat, so that no focusing is provided, or the areas adjacent the LEDs **82** could be formed with concave shapes, so that the light exiting the lens member **74** is dispersed for a flood light effect.

The switch **76** includes a switch housing **112** with a pair of electrical terminals **114** extending from a rear surface **116** thereof and a switch rocker (not shown) on a front surface opposite the surface **116**. One of the terminals **114** is connected to the power source through the power cord **56** and the other of the terminals **114** is connected to the input to the converter **80** on the circuit board assembly **70** (Fig. 5). The switch **76** is selectively actuatable to provide AC power from the power source to the circuit board assembly **70**. The switch **76** is easily actuated by a thumb or finger of a person (not shown) holding the handle portion **20** to light the LEDs **82** of the circuit board assembly **70** with one hand while also orienting the light **10** with the same hand.

Referring now to Fig. 6, an alternative embodiment of a utility light in accordance with the present invention is indicated generally at **10'**. The utility light **10'** includes many elements common with the utility light **10** shown in Figs. 1-4, and some reference numerals are omitted for clarity. The utility light **10'** includes a vertically split hollow light housing **12'** formed from a rear housing shell **14'** and a front housing shell **16'**. When attached, the housing shells **14'** and **16'** define an elongated upper light portion **18'** extending from a

hollow lower handle portion **20'**. The housing **12'** differs mainly from the housing **12** by being taller to accommodate additional LEDs **82**. A center one of the strengthening ribs **22** has at opposite ends thereof, instead of the support pins **94**, a pair of bosses **118** each including a through aperture **120** for receiving a fastener (not shown).

5           The hollow housing **12'** defines a space between the rear shell **14'** and the front shell **16'** for receiving a plurality of lighting components, including an LED circuit board assembly **70'**, a reflector member **72'**, a lens member **74'**, and the switch **76**. The LED circuit board assembly **70'**, the reflector member **72'**, and the lens member **74'** are correspondingly greater in length than the LED circuit board assembly **70**, the reflector  
10 member **72**, and the lens member **74** respectively due to an increased number of the LEDs **82**. As shown, sixty LEDs **82** are arranged in an array of twenty rows of three LEDs each. Those skilled in the art will appreciate that the length of the utility light according to the present invention may be selected to be greater or less than the lengths of the housings **12** and **12'** depending upon the number and the shape of the array of the LEDs **82**.

15           In order to accommodate the bosses **118**, a recess **122** is formed in the opposite sides of the circuit board assembly **70'**, a recess **124** is formed in opposite sides of the reflector member **72'**, and a recess **126** is formed in opposite sides of the lens member **74'**. The recesses **122**, **124**, and **126** accommodate the bosses **118** and corresponding posts **128** extending from the front housing shell **16'** to receive the fasteners (not shown) when the  
20 housing shells **14'** and **16'** are assembled. The electrical schematic for the utility light **10'** is substantially as shown in Fig. 5.

Referring now to Figs. 7-10, an alternative embodiment of a rechargeable LED utility light in accordance with the present invention is indicated generally at **210**. The utility light **210** includes a horizontally split hollow light housing **212** formed with a rear or  
25 lower housing half **214** and a front or upper housing half **216**. When attached, the housing halves **214** and **216** define an upper light portion **218** extending from a hollow lower handle portion **220**. The front housing half **216** has a lens opening **219** formed in the upper light portion **218**. The housing halves **214** and **216** are substantially arcuate in cross section to form the housing **212** with a substantially oval cross section (see Fig. 13). The housing **212**  
30 is preferably formed of a lightweight material, such as plastic or the like, as the utility light **210** is contemplated to be both handheld and portable. The rear housing half **214** includes a plurality of strengthening ribs **222** extending across interior walls thereof. A plurality of

bosses **224** having a larger diameter portion **226** and a smaller diameter portion **228** extend from an inner surface **230** of the rear housing half **214** for receiving respective fasteners (not shown). The fasteners extend through the bosses **224** from corresponding posts **232** formed in and extending inwardly from an interior surface **217** of the front housing half **216** 5 to secure the halves **214** and **216** together to form the housing **212**, discussed in more detail below. During assembly, the smaller diameter portion **228** of each of the bosses **224** is received by a corresponding aperture **234** formed in an associated one of the posts **232** of the front housing half **216**.

An exterior surface **236** of the light portion **218** of the rear housing half **214** is 10 formed to define a recess **238** for receiving and storing a hook member **240** therein. The hook member **240** includes a ball portion **242** that is connected to a shank portion **244**. The recess **238** has closed bottom wall **246** at the interior surface **230** of the rear housing half **214**, best seen in Fig. 8. The wall **246** interrupts at least a portion of two of the strengthening ribs **222**. The shape of the recess **238** corresponds to the shape of the hook 15 member **240** in plan view. When the hook member **240** is disposed in the recess **238**, the hook member **240** does not extend above the exterior surface **236** of the rear housing half **214**. Adjacent a lower portion of the recess **238** is a sloped surface **236a** of the exterior surface **236** that provides access to the hook member **240** for improved removal and stowage for the hook member **240**. A plurality of elongated vent openings **237** are 20 formed in the wall of the rear housing half **214**, which provide a flow of cooling air for the electric components disposed in the light housing **212**, discussed in more detail below.

The ball portion **242** of the hook member **240** cooperates with a hook ball retainer **248** disposed between the housing halves **214** and **216** when the housing **212** is 25 assembled. The hook ball retainer **248** includes a pair of fastener receivers **250** extending from opposing sides of a ball receiver **252**. The fastener receivers **250** are placed between an upper pair of mating bosses **224** and posts **232** of the light portion **218**. The ball receiver **252**, in conjunction with a curved surface **254** defining an upper aperture **256** in the rear housing half **214**, receive the ball portion **242** of the hook 30 member **240**. After the ball portion **240** is snap fit into the aperture **256**, the ball portion **240**, the ball receiver **252** and the curved surface **254** function as a ball and socket connection. As shown in Fig. 12, this connection allows the hook member **240** to rotate

between the stored position to an extended position as indicated by an arrow **45**. Once out of the recess **238**, the hook member **240** is free to rotate about its longitudinal axis. The hook member **240**, therefore, provides a means for placing and orienting the utility light **210** during use.

5 Each of a pair of elongated handle cushions **260** includes a plurality of attachment fingers **262** having a stop portion **264** and a shaft portion **266**. The handle cushions **260** are each attached to the handle portion **220** of the housing **212** by placing the shaft portion **266** of the attachment fingers **262** in corresponding grooves **268** formed between the rear half **214** and the upper half **216** of the housing **212**. The stop portions **264** prevent accidental  
10 removal of the cushions **260** from the housing **212** after the housing **212** has been assembled. The handle cushions **260** are each preferably constructed of a soft, easily deflectable material.

A battery **270** is disposed in a recess formed between the rear half **214** and the front half **216** of the handle portion **220**. The battery **270** is preferably a rechargeable battery,  
15 such as a nickel metal hydride battery or similar rechargeable-type battery. The battery **270** is maintained in its position in the recess by a battery retainer **272** (see Fig. 10) disposed on an upper surface thereof. The battery retainer **272** includes a pair of legs **274** each extending downwardly from opposing ends thereof and defining an aperture **276** therein, and a pair of wing portions **278** extending upwardly from the opposing ends. The apertures  
20 **276** of the legs **274** each receive a free end of a post **280** extending upwardly from the interior surface **217** of the front housing half **216**. The wing portions **278** extend beyond the outer edges of the battery **270** to provide additional support for the battery **270** when the utility light **210** is assembled.

The hollow housing **212** defines a space between the rear half **214** and the front half  
25 **216** thereof for receiving a plurality of electrical lighting components, including an LED circuit board assembly **282**, a reflector member **284**, a lens member **286**, and a switch **288**. The switch **288** is disposed in an aperture **290** formed in the rear half **214** of the housing **212** and electrically connects power from the battery **270** to the LED circuit board assembly **282**. No power converter for the circuit board assembly **282** is necessary since the battery  
30 **270** is a DC power source, advantageously reducing the size and weight of the utility light **210**. The LED circuit board assembly **282** includes a plurality of LEDs **292**, best seen in Figs. 12 and 13, extending from an upper surface **294** thereof. The LEDs **292** are operable

to emit light in a well-known manner when electrical power is connected from the battery 270 to the circuit board assembly 282 through the switch 288. A plug circuit board 287 is disposed between the rear half 214 and the front half 216 of the housing 212 and electrically connects a pin-type electrical plug 289 and the battery 270. The plug circuit  
5 board 287 is preferably attached to a pair of posts 281 extending upwardly from the interior surface 217 of the front housing half 216. The plug 289 is disposed in an aperture 291 formed between the rear half 214 and the front half 216 of the housing 212.

The reflector member 284 is fit over the front surface of the LED circuit board assembly 282. The reflector member 284 includes a plurality of spaced apart through  
10 apertures 285. The front surface of the reflector member 284 is preferably mirror chrome plated or has a similar highly reflective surface. The number of apertures 285 corresponds to the number of LEDs 292 on the circuit board assembly 282. The walls of the reflector member 284 that define each of the apertures 285 are also mirror chrome plated and taper radially outwardly from the rear surface of the reflector member 284 to the front surface of  
15 the reflector member 284 to form a generally cone-shape profile, best seen in Fig. 12. A width, indicated by an arrow 296 in Fig. 8, of the reflector member 284 is greater than a width, indicated by an arrow 298, of the circuit board assembly 282. A plurality of support legs 300 is formed on the periphery of the reflector member 284. The support legs 300 extend rearwardly from the rear surface of the reflector member 284 and, because the width  
20 296 is greater than the width 298, when the reflector member 284 is placed over the circuit board assembly 282 the support legs extend beyond the periphery of the circuit board assembly 282 and rearwardly of the rear surface of the circuit board assembly 282. The support legs 300 engage with corresponding support pins 302 extending inwardly from outer edges of the support ribs 222 of the lower housing half 214. A flange 320 extends  
25 from opposed upper and lower ends of the reflector member 284. The flange 320 has an upwardly extending portion 320a and an outwardly extending portion 320b, best seen in Fig 6.

The lens member 286 is received in the lens opening 219 extending through the upper portion of the front housing half 216 during assembly of the utility light 210. The  
30 lens member 286 is preferably constructed of clear plastic material or similar material. The lens member 286 includes a plurality of posts 304 extending rearwardly therefrom that cooperate with apertures 306 formed in the reflector member 284 and with apertures 308

formed in the circuit board assembly **282** during assembly of the utility light **210**. The lens member **286** includes a flange **322** extending from opposed upper and lower ends thereof. The flange **322** includes a stepped portion **322a**, best seen in Fig. 12. A flange **323** extends from opposed ends of the front housing half **216** that define the aperture **302**, best seen in Fig. 6, for cooperating with the stepped portions **322a** during assembly of the utility light **210**.

As seen in Figs. 12 and 13, the lens member **286** has a plurality of focusing portions **325** that correspond in number and position to the LEDs **292**. Each of the focusing portions **325** is formed as a convex protrusion on the rear surface of the lens member **286** facing the reflector member **284**. The focusing portions **325** collect and focus light from the corresponding LEDs **292** to generate a collective focused beam of light exiting the lens member **286**. However, the rear surface of the lens member **286** could be flat, so that no focusing is provided, or the areas adjacent the LEDs **292** could be formed with concave shapes, so that the light exiting the lens member **286** is dispersed for a flood light effect.

A lanyard **310** is preferably provided for routing through a hole **314** formed in a flange **312** on a lower portion of the rear housing half **214**. An A/C transformer means **316** is preferably provided for attachment to the electrical plug **289** for recharging the battery **270**. The transformer means **316** connects to a source of standard AC power "120 V", reduces it to a lower voltage and converts to DC power to operate the LEDs **292**. A carrying case **318** is preferably provided for attachment to a belt loop or the like (not shown) for ease of portability of the utility light **210**.

During assembly of the utility light **210**, the hook member **240** and the handle cushions **260** are placed in their respective mounting locations. The switch **288** is placed in the aperture **290**, the reflector member **284** is fit over the upper surface **294** of the LED circuit board assembly **282** (placing the LEDs **292** in the respective apertures **285** of the reflector member **284**), and the support legs **300** are placed on the support pins **302**. The battery retainer **272** is placed on the posts **280** and the battery **270** is placed on the battery retainer **272**. The lens member **286** is placed in the aperture **302**, and the stepped portion **322a** engages with the flange **323** of the upper housing half **216** to retain the lens member **286** in the aperture **302**. Alternatively, the lens member **286** is placed on the reflector **284** with the stepped portion **322a** resting on the outwardly extending portion **320b**. The upper housing half **216** is placed on the lower housing half **214**, and a flange

**324** on the outer edge of the upper housing half **216** overlaps a corresponding flange **326** on the outer edge of the lower housing half **214**, best seen in Fig. 12, and the respective bosses **224** are received and engaged in corresponding posts **232**, best seen in Fig. 12. When the halves **214** and **216** are joined, a tongue **328** extending from a rear edge of the  
5 housing half **214** cooperates with a groove **330** formed between a pair of flanges **332** extending from a rear edge of the housing half **216**, best seen in Fig. 13, to provide ease of alignment of the split halves **214** and **216** during assembly of the light housing **212**. A flange **334** on the outer edge of the upper housing half **216** overlaps a corresponding flange **336** on the outer edge of the lens member **286**, best seen in Fig. 13. Fasteners  
10 such as screws (not shown) or the like are then placed in each of the engaging bosses **224** and posts **232** and the housing halves **214** and **216** are secured together to form the housing **212**.

The switch **288** includes a switch housing **288a** with a pair of electrical terminals (not shown) extending from a lower surface thereof and a switch rocker **288b** on an upper  
15 surface. One of the terminals is connected to the battery **270** through the circuit board **287** and the other of the terminals is connected to the LED circuit board assembly **282**. The switch rocker in the on and off positions alternately provides power from the battery **270** to the LED circuit board assembly **282**. The switch **276** is easily actuated by a thumb or finger of a person (not shown) holding the handle portion **220** to light the LEDs **292** of the  
20 circuit board assembly **282** with one hand while also orienting and hanging the light **10** with the same hand.

An electrical schematic of the utility light **210** is shown in Fig. 14. The A/C transformer **316** is provided for a charging connection from an external power source **117** through the transformer **316** to the battery **270**. The electrical power from the battery **270** is  
25 directed through the switch **288** to the LED circuit board assembly **282**.

Referring now to Figs. 15-20, an alternative embodiment of a rechargeable LED utility light in accordance with the present invention is indicated generally at **410**. The utility light **410** includes a vertically and horizontally split hollow light housing **412** formed with a first or upper rear housing portion **414a**, a second or lower rear housing  
30 portion **414b**, and a front housing portion **416**. When attached, the rear housing portions **414a** and **414b** and the front housing portion **416** form the housing **412** with an upper light portion **418** extending from a lower handle portion **420**. The front housing portion

**416** has a lens opening **419** formed in the upper light portion **418**. The rear housing portions **414a** and **414b** and the front housing **416** are substantially arcuate in horizontal cross section to form the housing **412** with a substantially oval cross section (Fig. 19). The housing **412** is preferably formed of a lightweight material, such as plastic or the like, as the utility light **410** is contemplated to be both handheld and portable. The rear housing portions **414a** and **414b** each include a plurality of strengthening ribs extending transverse to a longitudinal axis of the light and across interior walls thereof. There is shown in Fig. 17a a plurality of ribs **422c** having curved exposed edges. There is shown in Fig. 17b a plurality of ribs **422a** and **422b** having straight exposed edges.

10 A plurality of tubular bosses **424**, two on the housing portion **414a** and four on the housing portion **414b**, having a larger diameter base **426** and a smaller diameter free end **428** extend from respective inner surfaces **430a** and **430b** of the rear housing portions **414a** and **414b** for receiving respective fasteners **431** (Fig. 20). Each boss **424** is open to an associated recess **429** in an exterior surface of the respective rear housing  
15 portion. The fasteners **431** extend through the recesses **429** and the bosses **424** and threadably engage corresponding posts **432** extending inwardly from an interior surface **417** of the front housing portion **416** to secure the rear housing portions **414a** and **414b** and the front housing portion **416** together to form the housing **412**. The front housing portion **416** includes a plurality of transverse strengthening ribs **423a** and **423b** extending  
20 from the interior surface **417** and having straight exposed edges. During assembly, the smaller diameter end **428** of each of the bosses **424** is received by a corresponding aperture or counterbore **434** formed in a free end of an associated one of the posts **432** of the front housing portion **416**.

An exterior surface **436a** of the upper rear housing portion **414a** has a hook recess  
25 or channel **438a** formed therein and an exterior surface **436b** of the lower rear housing portion **414b** has a hook recess or channel **438b** formed therein, each recess receiving and releasably storing a hook member **440** therein. The hook members **440** include, respectively, a ball portion **442** that is attached to a shank portion **444**. The recesses **438a** and **438b** each have a respective closed bottom wall **446a** (Fig. 17a) and **446b** (Fig.  
30 17b) at the interior surfaces **430a** and **430b** of the rear housing portions **414a** and **414b**, best seen in Figs. 17a and 17b. The wall **446a** interrupts two of the ribs **422c** in the upper housing portion **414a**, while the wall **446b** extends through but not above the ribs

in the lower housing portion **414b**. The shape of the recesses **438a** and **438b** corresponds to the shape of the hook members **440** in plan view. When the hook members **440** are disposed in a “stored” position in the respective recess **438a** and **438b**, the hook members **440** do not extend above the exterior surfaces **436a** and **436b** of the rear housing portions **414a** and **414b**. Formed in a side wall of a hook portion of each of the recesses **438a** and **438b** is a respective sloped surface **437a** and **437b** that provides access to the hook members **440** by a human finger for improved removal and stowage for the hook members **440**.

The ball portion **442** of each of the hook members **440** cooperates with a respective ball retainer **448** disposed between each of the rear housing portions **414a** and **414b** and the front housing portion **416** when the housing **412** is assembled. Each ball retainer **448** includes a pair of retaining arms **450** extending from opposing sides of a cup shaped ball receiver **452**. Each of the retaining arms **450** is apertured to receive an associated one of the ends **428** of the mating bosses **424** of the light portion **418** and handle portion **420**, respectively. Each of the ball receivers **452** cooperates with a pair of curved surfaces **454** formed on opposite sides of apertures **456a** and **456b** in the walls **446a** and **446b** respectively to retain the ball portion **442** of the hook member **440**. The ball receivers **452**, the surfaces **454** and the ball portions **440** function as ball and socket attachments for the hook members **440**. As shown in Fig. 18, the hook members **440** can rotate between the stored position shown and an extended “use” position as indicated by an arrow **445**. Once out of the recesses **438a** and **438b**, the hook members **440** are free to rotate about their respective longitudinal axes. The hook members **440**, therefore, provide a means for placing and orienting the utility light **410** during use.

Each of a pair of elongated handle cushions **460** includes a plurality of attachment fingers **462** extending from a rear surface and having a stop portion **464** and a shaft portion **466**. The handle cushions **460** are attached to opposite sides of the handle portion **420** of the housing **412** with each of the shaft portions **466** received in corresponding recesses **468** formed in the mating edges of lower rear housing portion **414b** and the front housing portion **416**. The stop portions **464** prevent removal of the cushions **460** from the housing **412** after assembly. The handle cushions **460** are each preferably constructed of a soft, easily deflectable material and include transverse grooves **467** formed in an outer surface shaped and spaced for receiving human fingers.

A battery **470** is disposed in a cavity formed between the lower rear housing portion **414b** and the front housing portion **416** of the handle portion **420**. The battery **470** is preferably a rechargeable battery of conventional type, such as a nickel metal hydride battery or similar rechargeable-type battery. The battery **470** is maintained in  
5 position in the cavity between the ribs **423a** and **422a** (front-to-rear) and between the mating pairs of the ribs **422b** and **423b** (top-to-bottom). A plurality of protrusions **472** (Fig. 16b) extending from the interior surface **417** of the front housing portion **416** cooperate with a corresponding plurality of recesses **474** formed in the lower rear housing portion **414b** to align the housing portions and prevent side-to-side movement of  
10 the battery **470**.

The hollow housing **412** also forms a space between the upper rear housing portion **414a** and the front housing portion **416** for receiving a light source such as an LED circuit board assembly **476** having a plurality of LEDs **486** mounted on a front surface **488** and a switch **478** extending from a rear surface thereof. A reflector member  
15 **480** is positioned between the assembly **476** and a lens member **482**. The switch **478** is preferably a push button type and extends through an aperture **484** formed in the upper rear housing portion **414a**. The LEDs **486**, best seen in Fig. 19, extend from a front surface **488** of the assembly **476**. The LEDs **486** are connected to the battery **470** through the switch **478** for selective operation to emit light through the lens **482**.

20 The reflector member **480** includes a plurality of spaced apart through apertures **481**. The front surface of the reflector member **480** is preferably mirror chrome plated or has a similar highly reflective surface. The apertures **481** correspond in number and position to the LEDs **486** on the circuit board assembly **476**. The walls of the reflector member **480** that define each of the apertures **481** are also mirror chrome plated and taper  
25 radially outwardly from the rear surface of the reflector member **480** to the front surface of the reflector member **480** to form a generally cone-shape profile, best seen in Fig. 19. A width, indicated by an arrow **492** in Fig. 16a, of the reflector member **480** is greater than a width, indicated by an arrow **490**, of the circuit board assembly **476**. A plurality of tubular support legs **494** is formed on the periphery of the reflector member **480**. The  
30 support legs **494** extend rearwardly from the rear surface of the reflector member **480** and, because the width **492** is greater than the width **490**, when the reflector member **480** is placed over the circuit board assembly **476**, the support legs **494** extend beyond the

periphery of the circuit board assembly **476** and rearwardly of the rear surface of the circuit board assembly **476**. The support legs **494** engage with corresponding support pins **496** extending inwardly from outer edges of the support ribs **422c** of the upper rear housing portion **414a**. A flange **483** extends from opposed upper and lower ends of the  
5 reflector member **480**. The flange **483** has an upwardly extending portion **483a** and an outwardly extending portion **483b**, best seen in Fig 18.

The lens member **482** is received in the lens opening **419** extending through the upper portion of the front housing portion **416** during assembly of the utility light **410**. The lens member **482** is preferably constructed of clear plastic material or similar  
10 material. The lens member **482** includes a plurality of posts **498** extending rearwardly therefrom that cooperate with apertures **500** formed in the reflector member **480** during assembly of the utility light **410**. The lens member **482** includes a flange **485** extending from opposed upper and lower ends thereof. The flange **485** includes a stepped portion  
15 **485a**, best seen in Fig. 18. A flange **415** extends from each of upper and lower edges that define the lens opening **419**, best seen in Fig. 18, for cooperating with the stepped portions **485a** during assembly of the utility light **410**.

As seen in Fig. 19 the lens member **482** has a plurality of focusing portions **504** that correspond in number and position to the LEDs **486**. Each of the focusing portions  
20 **504** is formed as a convex protrusion on the rear surface of the lens member **482** facing the reflector member **480**. The focusing portions **504** collect and focus light from the corresponding LEDs **486** to generate a collective focused beam of light exiting the lens member **482**. However, the rear surface of the lens member **482** could be flat, so that no focusing is provided, or the areas adjacent the LEDs **486** could be formed with concave shapes, so that the light exiting the lens member **482** is dispersed for a flood light effect.

25 A pair of charging contacts **506** are each disposed in a corresponding slot **508** formed between the lower rear housing portion **414b** and the front housing portion **416** when the housing **412** is assembled. The contacts **506** are electrically connected to the battery **470**. The contacts **506** are adapted to engage with corresponding electrical contacts (not shown) provided in a bottom of an upwardly facing docking cavity **510** of a  
30 charging base **512**, best seen in Fig. 20. The cavity **510** is contoured to the shape of the lower end of the housing **412**. The charging base **512** includes an aperture **514** formed in a rear wall for passing a power cord (not shown). The power cord connects between a

source of AC power, such as a wall plug, and a converter circuit with integral transformer, discussed in more detail below, for charging the battery 470 when the utility light 410 is placed in the charging base 512. The charging base 512 also includes elongated attachment slots 516 formed in the rear wall for easier mounting on the charging base on, for example, a wall (not shown) or the like.

The switch 478 is easily actuated by a thumb or finger of a person (not shown) holding the handle portion 420 to light the LEDs 486 of the circuit board assembly 476 with one hand while also orienting and hanging the light 410 with the same hand. A flexible cover 479 can be provided on the switch 478 to protect it from dirt and liquids.

10 An electrical schematic of the utility light 410 is shown in Fig. 21. An AC to DC converter 530 is provided in the charging base 512 for converting AC power from a source 528 to the lower voltage DC power required to charge the battery 470 when the utility light 410 is placed in the charging base 512. The charging base 512 may also include LED indicator lights 532, such as a red LED (off) and a green LED (on), to  
15 indicate the charging status of the utility light 410, preferably mounted in a front surface of the base 512. Those skilled in the art, however, will appreciate that the indicator lights 532 may be located on any surface of the base 512 to enable a user to ascertain the charging status of the utility light 410.

The electrical power from the battery 470 is directed through the switch 478 to  
20 the LED circuit board assembly 476. The switch 478 has at least a pair of "on" positions wherein in a first "on" position the switch 478 can direct electrical power from the battery 470 to a first or central group 486a of the LEDs 486 wherein only those LEDs in a central portion of the assembly 476 are lighted. In a second "on" position, the switch 478 directs power to light a second group 486b including all of the LEDs 486. The  
25 utility light 410 also includes a low battery voltage detector 534 that, when the voltage in the battery 470 drops below a predetermined level, will provide power to a low battery power indicator 536. The indicator 536 is preferably a red LED mounted in an aperture in the front housing portion 416, best seen in Fig. 15. The indicator 536 will blink intermittently when the battery voltage is low. Alternatively, the low battery voltage  
30 detector 534 can be connected directly (dashed line) to the LED circuit board assembly 476 to cause selected ones of the LEDs 486, such as the first group 486a, to flash and indicate to the user that the battery 470 is low.

The utility light **410** shown in Figs. 15-20 has the LEDs **486** arranged in four columns of twelve rows for a total of forty-eight LEDs. The center two columns can be the first group **486a** such that one half of the total light output is generated by twenty-four LEDs in the first "on" position of the switch **478**. All of the columns can be included in the second group **486b** such that the total light output is generated by forty-eight LEDs in the second "on" position of the switch **478**. An alternative array can consist of three columns and eight rows for a total of twenty-four LEDs. In that case, the center column can be the first group **486a** and all the LEDs can be the second group **486b**. The twenty-four LED array permits a smaller housing **412** since the battery **470** and the circuit board assembly **476** will be smaller.

In another alternative embodiment, the switch **478** can be a double switch wherein the group **486a** can be controlled by one switch button and the group **486b** can be the remaining LEDs and can be controlled by another switch button. For example, the utility light **410** shown in Figs. 15-21 could have half of the LEDs **486** controlled by the one switch button and the other half of the LEDs controlled by the other switch button.

Of course, any number of LEDs can be used.

For example, an array of four columns and six rows results in a total of twenty-four LEDs. An array of three columns and ten rows results in a total of thirty LEDs, and an array of three columns and twenty rows or a total of sixty LEDs.

Referring now to Figs. 22-25, an LED utility light in accordance with the present invention is indicated generally at **610**. The utility light **610** includes a hollow light housing **612** split on a vertical plane into a rear housing portion **614** and a front housing portion **616**. When attached, the housing portions **614** and **616** define an elongated upper light portion **618**, having a first width indicated by an arrow **618a**, extending from a lower handle portion **620**, having a second width indicated by an arrow **620a** that is less than the first width. The housing portions **614** and **616** are substantially arcuate in cross section and, when attached, form the housing **612** with a substantially oval cross section, best seen in Fig. 27. The housing **612** is preferably formed of a lightweight material, such as plastic or the like, as the utility light **610** is contemplated to be both handheld and portable. The rear housing portion **614** includes a plurality of transverse strengthening ribs **622** (Fig. 24) extending generally horizontally across interior walls thereof. A plurality of tubular bosses **624** each having a larger diameter base **626** and a smaller

diameter free end **628** extend from an inner surface **630** of the rear housing portion **614** for receiving respective fasteners **633** (Fig. 22) inserted into corresponding apertures **631** formed in the housing portion **614**. The fasteners **633** extend through the bosses **624** and threadably engage corresponding posts **632** (Fig. 25) formed in and extending inwardly  
5 from an inner surface **617** of the front housing portion **616** to secure the housing portions **614** and **616** together to form the housing **612**, discussed in more detail below. The front housing portion **616** includes a plurality of transverse strengthening ribs **623** extending across the inner wall thereof. During assembly, the smaller diameter free end **628** of each of the bosses **624** is received by a corresponding aperture **634** formed in an  
10 associated one of the posts **632** of the front housing portion **616**.

An exterior surface **636** of the rear housing portion **614** is formed to define a hook recess **638** for receiving and storing a hook member **640** therein. The hook member **640** includes a ball portion **642** that is connected to a shank portion **644**. The recess **638** has a respective closed bottom wall **646** at the inner surface **630** the rear housing portion  
15 **614**, best seen in Fig. 23. The wall **646** does not extend above the ribs **622** in the rear housing portion **614**. The shape of the recess **638** corresponds to the shape of the hook member **640** in plan view. When the hook member **640** is disposed in the recess **638**, the hook member **640** does not extend above the exterior surface **636** of the rear housing portion **614**. Formed in a side wall of the recess **638** is a sloped surface **637** that  
20 provides access to the hook member **640** by a human finger for improved removal and stowage of the hook member **640**.

The ball portion **642** of the hook member **640** cooperates with a ball retainer **643** disposed between the rear housing portion **614** and the front housing portion **616** when the housing **612** is assembled. The ball retainer **643** includes a pair of retaining arms  
25 **643a** extending from opposing sides of a cup shaped ball receiver. Each of the retaining arms **643a** is apertured to receive an associated one of the free ends **628** of the mating bosses **624**. The ball receiver **643** cooperates with a pair of curved surfaces formed on the inside of the rear housing portion **614** to retain the ball portion **642** of the hook member **640**. The ball receiver **643**, the surfaces and the ball portion **640** function as ball  
30 and socket attachments for the hook member **640**. As shown in Fig. 23, the hook member **640** can rotate between the stored position shown and an extended "use" position as indicated by an arrow **645**. Once out of the recess **638**, the hook member **640**

is free to rotate about its respective longitudinal axis. The hook member **640**, therefore, provides a means for placing and orienting the utility light **610** during use.

An upper cushion **647** is formed of a resilient material and is contoured to the shape of an upper end of the light housing **612**. A plurality of attachment fingers **648** extend from a lower surface of the cushion **647** and have a wider stop portion **650** at a free end of a narrower shaft portion **652**. The upper cushion **646** is attached to the top of the light portion **618** of the housing **612** by placing the shaft portion **652** of each of the attachment fingers **648** in a corresponding one of a plurality of grooves or cutouts **654** formed in the upper walls of the rear portion **614** and the front portion **616** of the housing **612**. The stop portions **650** prevent removal of the cushion **646** from the housing **612** after the housing has been assembled, as discussed in more detail below. Similarly, each one of a pair of elongated handle cushions **656** includes a plurality of attachment fingers **658** having a larger stop portion **660** and a smaller diameter shaft portion **662**. The handle cushions **656** are each attached to the handle portion **620** of the housing **612** by placing the shaft portions **662** of the attachment fingers **658** in corresponding ones of a plurality of grooves or cutouts **664** formed in facing edges of the rear portion **614** and the front portion **616** of the housing **612**. The stop portions **660** prevent removal of the cushions **656** from the housing **612** after the housing **612** has been assembled. The upper cushion **646** and the handle cushions **656** are each preferably constructed of a soft, easily deflectable resilient material.

A power cord, shown in Figs. 23 and 24 in phantom at **666**, extends through an aperture **668** in a bottom wall **621** of the front housing portion **616** and is used to provide power to the circuitry, discussed below, that is enclosed within the housing **612**. A strain relief **670** is adapted to be attached to the power cord **666**. The strain relief **670** has a pair of spaced flanges **672** that retain an edge **674** (Fig. 26) of the bottom wall **621** defining the aperture **668** to retain the power cord **666** in place should a pulling force be applied to the power cord. The end of the power cord **666** has a male plug (not shown) for insertion into a common female electrical power receptacle (not shown) to obtain AC power. An electrical receptacle **676** is disposed in an aperture **677** formed in a projection **678** extending adjacent the bottom end of the front housing portion **616** at an angle canted with respect to a longitudinal axis of the light housing **612**. An indicator **679** is disposed in an aperture formed in the exterior surface **636** of the rear housing portion **414**

adjacent the plug **676** to visually indicate when the receptacle **676** is connected to a source of electrical power through the cord **666**.

The hollow housing **612** defines a space between the rear portion **614** and the front portion **616** thereof for receiving a plurality of lighting components, including an LED circuit board assembly **680** having a switch **682** extending from a lower surface thereof, a reflector member **684**, and a lens member **686**. The switch **682** is preferably a push button type that extends through an aperture **688** formed in the rear housing portion **614** of the handle portion **620** of the housing **612**. The switch **682** electrically connects power from a power source **691** connected to the power cord **666** to an input of a conventional AC/DC power converter **690**, best seen in Fig. 28. The converter **690** can be a separate unit mounted in the handle portion **620**, or can be a circuit on the circuit board of the assembly **680**. The LED circuit board assembly **680** includes a plurality of LEDs **692** extending from a front surface **694** thereof. In the example shown, fifty LEDs **692** are arranged in an array having five columns and ten rows. The LEDs **692** are connected to an output of the converter **690** through the switch **682** and are operable to emit light in a well-known manner when a DC voltage is provided by the converter **690**. The LED circuit board assembly **680** includes a plurality of alignment holes **695** extending through opposite ends thereof. The alignment holes **695** engage with alignment pins **705** extending upwardly from outer edges of the support ribs **622** of the rear housing portion **614** and aid in the assembly of the utility light **610**.

The reflector member **684** is in the form of a planar mask that fits over the front surface **694** of the LED circuit board assembly **680**. The reflector member **684** includes a plurality of spaced apart apertures **696** formed therein. A front surface **685** of the reflector member **684** is preferably mirror chrome plated or has a similar highly reflective surface. The number and spacing of the apertures **696** corresponds to the number and spacing of the LEDs **692** on the circuit board assembly **680**. The walls of the reflector member **684** that define each of the apertures **696** are also mirror chrome plated and taper radially outwardly toward the front surface **685** to form a generally cone-shape profile, best seen in Figs. 24 and 25. A width, indicated by an arrow **698**, of the reflector member **684** is greater than a width, indicated by an arrow **700**, of the circuit board assembly **680**. A plurality of spaced support legs **702** extend from a rear surface of the reflector member **684** along side edges thereof. The spacing between the support legs

702 at opposed sides of the reflector member 684 is greater than the width 700 of the circuit board assembly 680 so that the support legs 702 extend beyond the side edges of the circuit board assembly 680 and engage with corresponding support pins 704 extending upwardly from outer edges of the support ribs 622 of the rear housing portion 5 614. A flange 683 extends from opposed upper and lower ends of the reflector member 684. The flange 683 has an upwardly extending portion 683a and an outwardly extending portion 683b, best seen in Fig 26.

The lens member 686 is received in an aperture 615 extending through an upper portion of the front housing portion 616 during assembly of the utility light 610. The 10 lens member 686 is preferably constructed of clear plastic material or similar material. The lens member 686 includes a flange 706 extending thereabout. The flange 706 includes a stepped portion 706a, best seen in Fig. 26. A flange 708 on the front housing portion 616 extends about the edges that define the aperture 615, best seen in Fig. 26, for retaining the stepped portion 706a upon assembly of the utility light 610.

15 Referring to Fig. 27, the front housing portion 616 has a peripheral flange 712 on the outer edge that overlaps a cooperating peripheral flange 714 on the outer edge of the rear housing portion 614 when the portions 614 and 616 are secured together by the fasteners 633 extending through the bosses 624 engaged in corresponding posts 632.

As seen in Figs. 26 and 27, the lens member 686 has a plurality of focusing 20 portions 710 that correspond in number and position to the LEDs 692. Each of the focusing portions 710 is formed as a convex protrusion on the rear surface of the lens member 686 facing the reflector member 684. The focusing portions 710 collect and focus light from the corresponding LEDs 692 to generate a collective focused beam of light exiting the lens member 686. However, the rear surface of the lens member 686 25 could be flat, so that no focusing is provided, or the areas adjacent the LEDs 692 could be formed with concave shapes, so that the light exiting the lens member 686 is dispersed for a flood light effect.

The switch 682 is easily actuated by a thumb or finger of a person (not shown) holding the handle portion 620 to light the LEDs 692 with one hand while also orienting 30 and hanging the light 610 with the same hand. A flexible cover 687 can be provided on the switch 682 to protect it from dirt and liquids.

A magnet assembly **716** is adapted to be attached to the exterior surface **636** of the rear housing portion **614**. The magnet assembly **716** includes a magnet slide bracket **718** that is attached to the rear housing portion by a fastener (not shown) extending through each aperture **720** (two are shown) formed in the slide bracket **718**. A slide member **722** includes a base **724** and an adjustment bracket **726** extending therefrom. The base **724** of the slide member **722** is adapted to be slidably disposed in a slot between spaced apart walls (not shown) on an outer surface of the slide bracket **718**. The adjustment bracket **726** includes a pair of spaced apart flanges **728** each having an aperture extending therethrough. The flanges **728** of the adjustment bracket **726** receive therebetween a washer **730** and a magnet bracket **732** extending from a magnet **734**. The washer **730** and the bracket **732** each include an aperture extending therethrough that receive, along with the apertures in the flanges **728**, a fastener **736** that is secured to the magnet assembly **716** by a handwheel or knob **738**. When the components of the magnet assembly **716** are attached to the utility light **610** and the magnet **734** is magnetically attached to a surface (not shown), the knob **738** allows the tension on the fastener **736** to be reduced and allows adjustment and orientation of the utility light **610** along an axis of rotation about the longitudinal axis of the fastener **736**. The magnet assembly **716** may be easily removed from the utility light **610** by sliding the slide member **722** out of the slot on the slide bracket **718**.

An electrical schematic of the utility light **610** is shown in Fig. 28. The AC to DC converter **690** is provided for converting AC power from the power source **691**, when the power cord **666** is connected to the power source **691**, to the lower voltage DC power required to power the LEDs **696** of the LED circuit board assembly **680**. When the power cord **666** is connected to the power source **691**, the plug **676** is also energized, advantageously allowing the user of the utility light **610** to power, for example, additional electrical tools (not shown).

The electrical power from the converter **690** is directed through the switch **682** to the LED circuit board assembly **680**. The switch **682** has at least a pair of "on" positions wherein in a first "on" position the switch **682** can direct electrical power from the converter **690** to a first or central group **692a** of the LEDs **692** wherein only those LEDs in a central portion, for example, of the assembly **680** are lighted. In a second "on" position, the switch **682** directs power to light a second group **692b** including all of the

LEDs **692**. The utility light **610** also includes the indicator **679** that, when the power cord **666** is connected to the power source **691** such that the converter **690** is energized, will indicate that the utility light **610** and the receptacle **676** are energized. The indicator **679** is preferably a red LED mounted in the aperture formed in the exterior surface **636** of the rear housing portion **614**, best seen in Fig. 22.

The utility light **610** shown in Figs. 22-27 has the LEDs **692** arranged in five columns of ten rows for a total of fifty LEDs. The center three columns can be the first group **692a** such that sixty per cent of the total light output is generated by thirty LEDs in the first "on" position of the switch **682**. All of the columns are included in the second group **692b** such that the total light output is generated by fifty LEDs in the second "on" position of the switch **682**. An alternative array can consist of three columns and eight rows for a total of twenty-four LEDs. In that case, the center column can be the first group **692a** and all the LEDs can be the second group **692b**. The twenty-four LED array permits a smaller housing **612** since the circuit board assembly **680** will be smaller.

Of course, any number of LEDs can be used. For example, an array of four columns and six rows results in a total of twenty-four LEDs. An array of three columns and ten rows results in a total of thirty LEDs, and an array of three columns and twenty rows results in a total of sixty LEDs.

In accordance with the provisions of the patent statutes, the present invention has been described in what is considered to represent its preferred embodiment. However, it should be noted that the invention can be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.

## WHAT IS CLAIMED IS:

1. A portable utility light, comprising:  
a hollow housing having a lens opening formed therein;  
5 a plurality of LEDs mounted in said hollow housing adjacent said lens opening;  
a reflector member mounted in said housing and having a plurality of apertures of  
cone-shaped profile formed therein, each of said apertures receiving an  
associated one of said LEDs; and  
a transparent lens member mounted in said lens opening permitting light  
10 generated from said LEDs to exit said housing.
2. The light according to Claim 1 including a battery disposed in said housing  
and connected to said LEDs by a switch.
- 15 3. The light according to Claim 1 including a hook member disposed in a recess  
formed in an exterior surface of said housing and being rotatable between a stored  
position in said recess and an extended position.
4. The light according to Claim 1 including a lanyard attached to said housing.  
20
5. The light according to Claim 1 including at least one handle cushion attached  
to said housing.
6. The light according to Claim 1 including a carrying case for receiving and  
25 retaining said housing.
7. The light according to Claim 1 wherein said lens member has a plurality of  
focusing portions formed thereon facing said LEDs for focusing light generated by said  
LEDs.

30

8. An LED utility light, comprising:  
a hollow housing having an upper light portion and a lower handle portion, said light portion having a lens aperture formed therein;  
an LED circuit board assembly disposed in said housing, said circuit board  
5 assembly including a plurality of LEDs arranged in a predetermined array and facing said lens opening;  
a reflector member mounted between said circuit board assembly and said lens opening, said reflector member having a plurality of light apertures formed therein corresponding to said array with each of said LEDs being  
10 visible through an associated one of said light apertures; and  
a lens member mounted in said lens opening for passing light generated by said LEDs.
9. The utility light according to Claim 8 including at least one cushion attached  
15 to said housing by at least one attachment finger engaging a cutout in said housing.
10. The utility light according to Claim 8 including an upper cushion mounted on said light portion.
- 20 11. The utility light according to Claim 8 including a hook member rotatably attached to said housing.
12. A portable utility light comprising:  
an elongated hollow light housing having a lens opening and a switch aperture  
25 formed therein;  
a plurality of LEDs mounted in said housing adjacent said lens opening; and  
a switch mounted in said switch aperture and connected to said LEDs for selectively applying electrical power to said LEDs, whereby when said  
30 switch is connected to a source of electrical power, said switch has a first "on" position connecting the source of electrical power to a first group of said LEDs being less than a plurality of said LEDs and a second "on"

position connecting the source of electrical power to a second group of said LEDs.

13. The light according to Claim 12 wherein said second group of said LEDs  
5 includes all of said LEDs.

14. The light according to Claim 12 wherein said second group of said LEDs includes all of said LEDs not included in said first group.

10 15. The light according to Claim 12 wherein said housing has a hook recess formed therein adjacent each of upper and lower ends of said housing and including a pair of hook members each attached to said housing for movement between a stored position in an associated one of said hook recesses and a use position out of said associated hook recess.

15

16. The light according to Claim 12 including a rechargeable battery mounted in said housing and being connected to said switch for providing electrical power to said LEDs, at least one electrical contact mounted on said housing and connected to said battery and a charging base for releasably retaining said housing and providing electrical  
20 power through said at least one electrical contact to recharge said battery.

17. The light according to Claim 16 including a pair of electrical contacts mounted on said light housing and connected to said battery and a charging base for releasably retaining said light housing and providing electrical power through said  
25 electrical contacts to recharge said battery.

18. The light according to Claim 17 including a low battery detector connected to said battery, an indicator aperture formed in said front housing portion and a low battery indicator mounted in said indicator aperture and being connected to said low battery  
30 detector for visually indicating a low battery condition of said battery.

19. An LED utility light comprising:  
a hollow housing having an upper light portion connected to a lower handle  
portion, said light portion having a lens opening formed therein;  
a plurality of LEDs mounted in said housing adjacent said lens opening;  
5 a transparent lens member mounted in said lens opening permitting light  
generated from said LEDs to exit said housing; and  
a magnet mounted on said housing and adapted to releasably retain the utility  
light on a support surface.

10 20. The light according to Claim 19 including a magnet assembly having said  
magnet and a bracket attached to said magnet, said bracket permitting rotational  
movement of said magnet about an axis generally parallel to a longitudinal axis of said  
housing.

15 21. The light according to Claim 19 including a magnet assembly having said  
magnet, a slide member attached to said magnet and a slide bracket attached to said  
housing, said slide member and said slide bracket cooperating to removably mount said  
magnet on said housing.

20 22. The light according to Claim 19 including an upper cushion formed of a  
resilient material and mounted on an upper end of said light portion of said housing.

23. The light according to Claim 19 including at least one handle cushion  
mounted on said housing at said handle portion.

25

24. The light according to Claim 19 including an electrical receptacle mounted in  
said housing adjacent a lower end of said handle portion.

25. The light according to Claim 24 including an indicator light mounted in said  
30 housing and being electrically connected to said electrical receptacle for visually  
indicating when electrical power is available at said electrical receptacle.

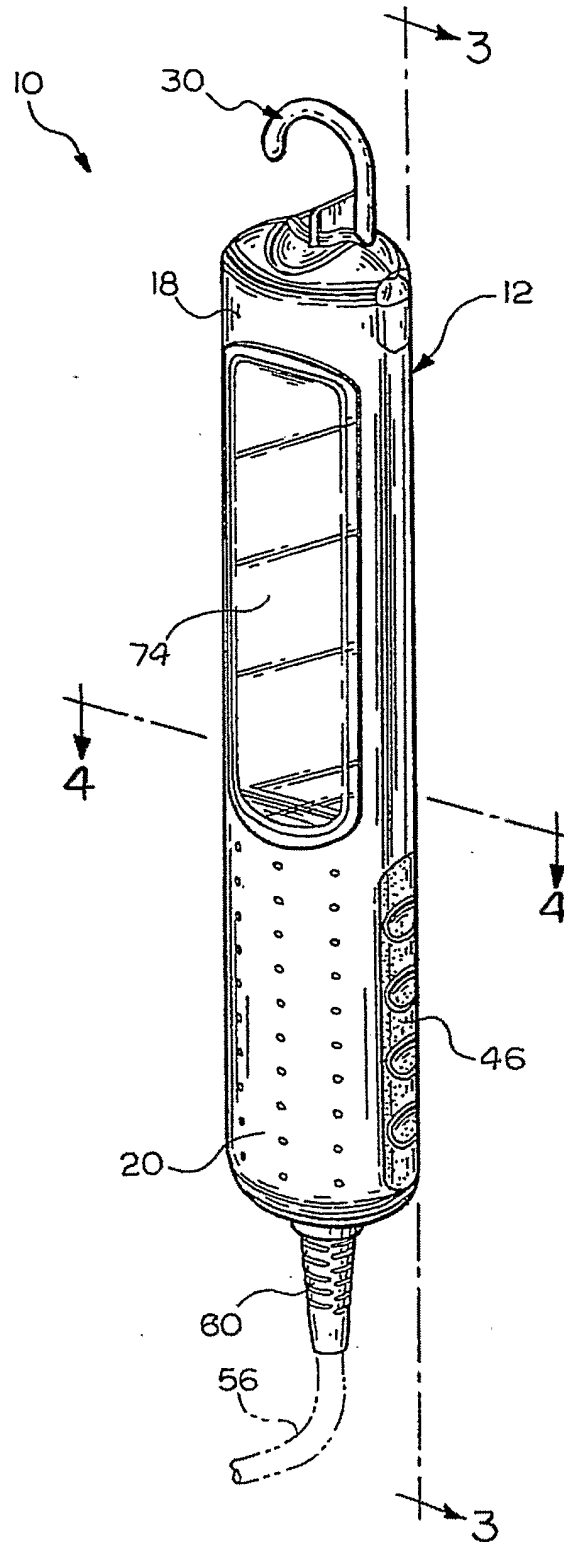


FIG. 1



3/25

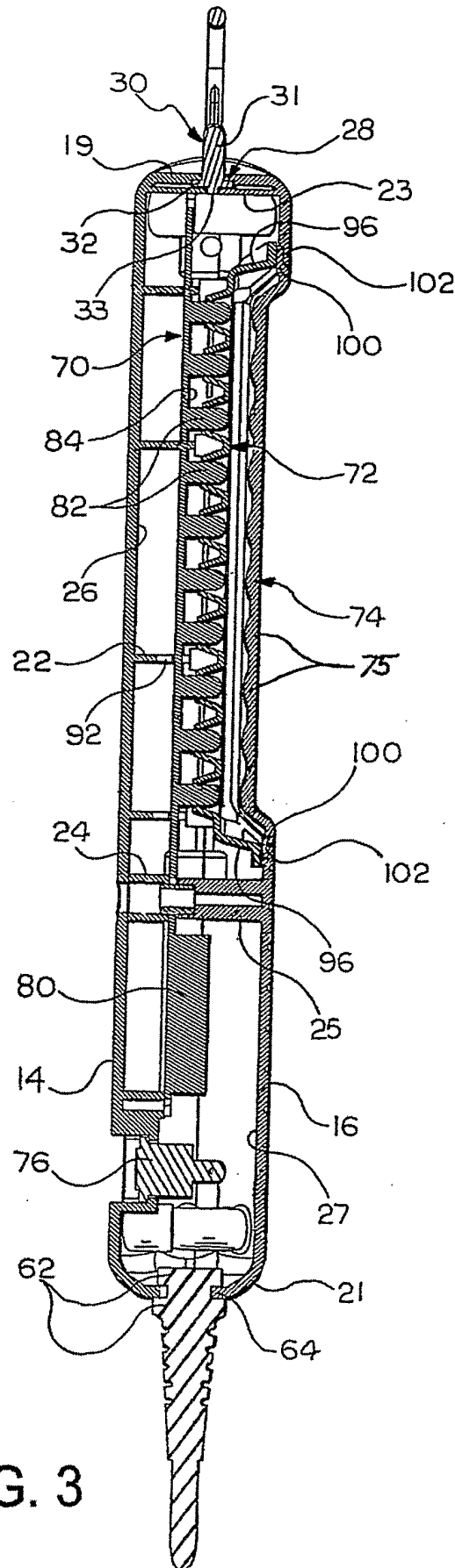


FIG. 3

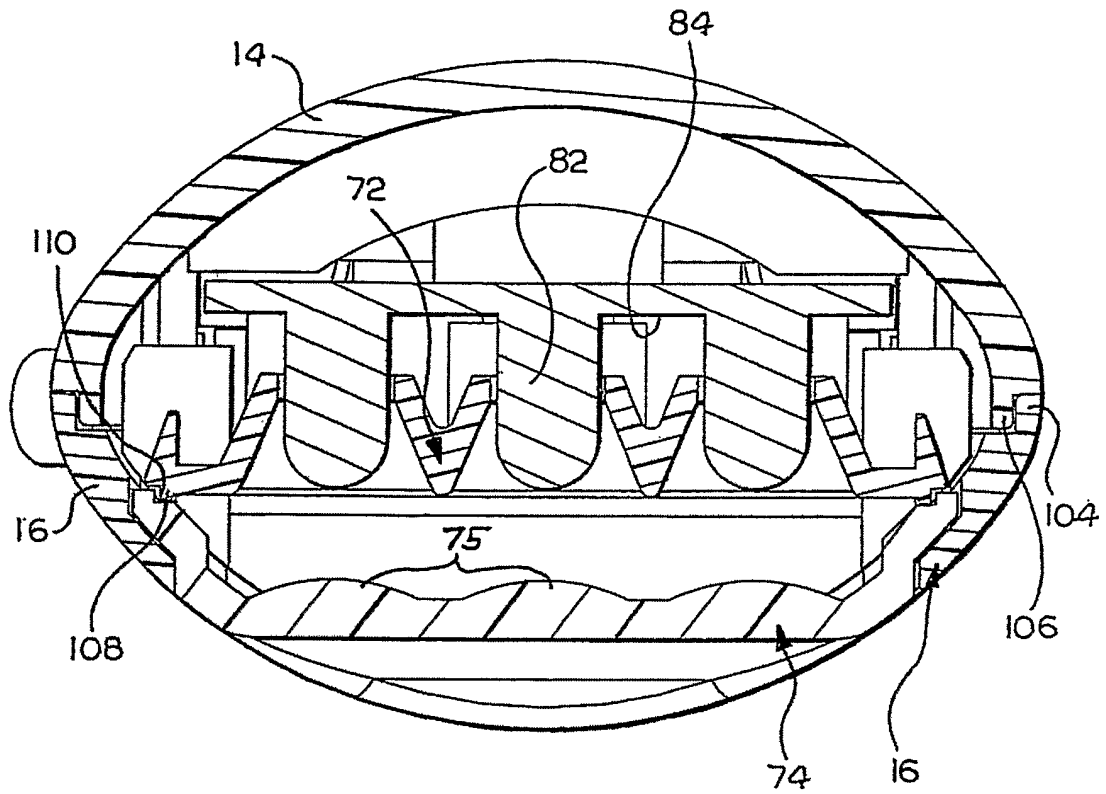


FIG. 4

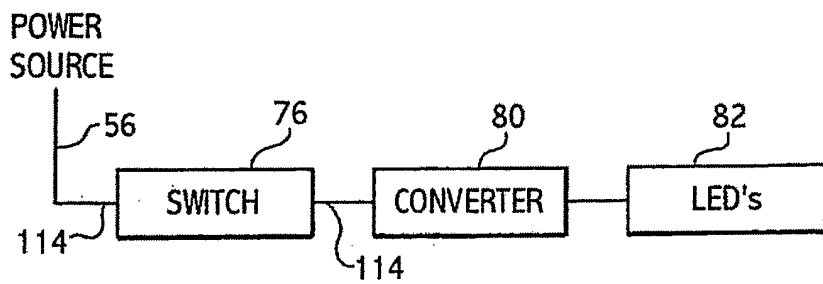


FIG. 5

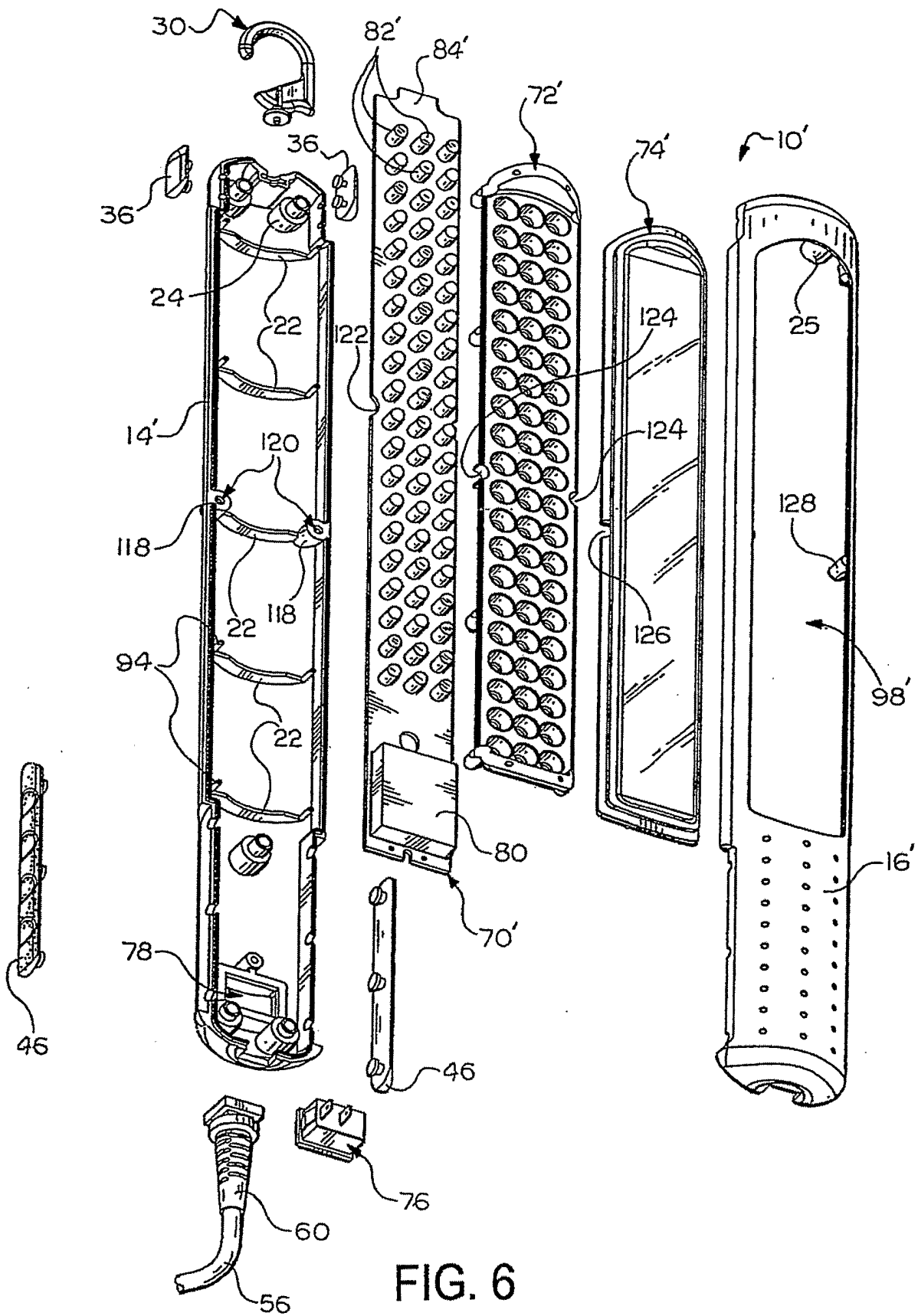


FIG. 6

6/25

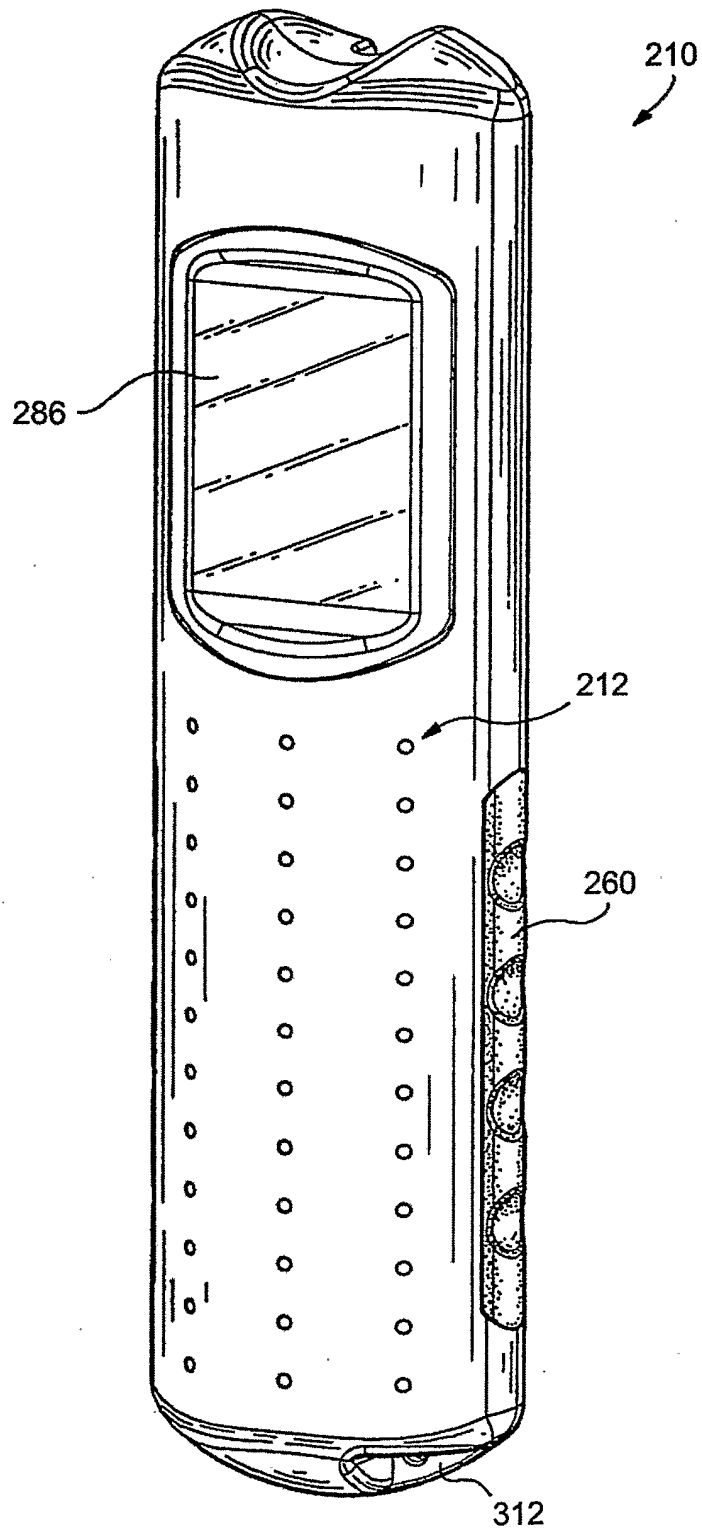


FIG. 7

7/25

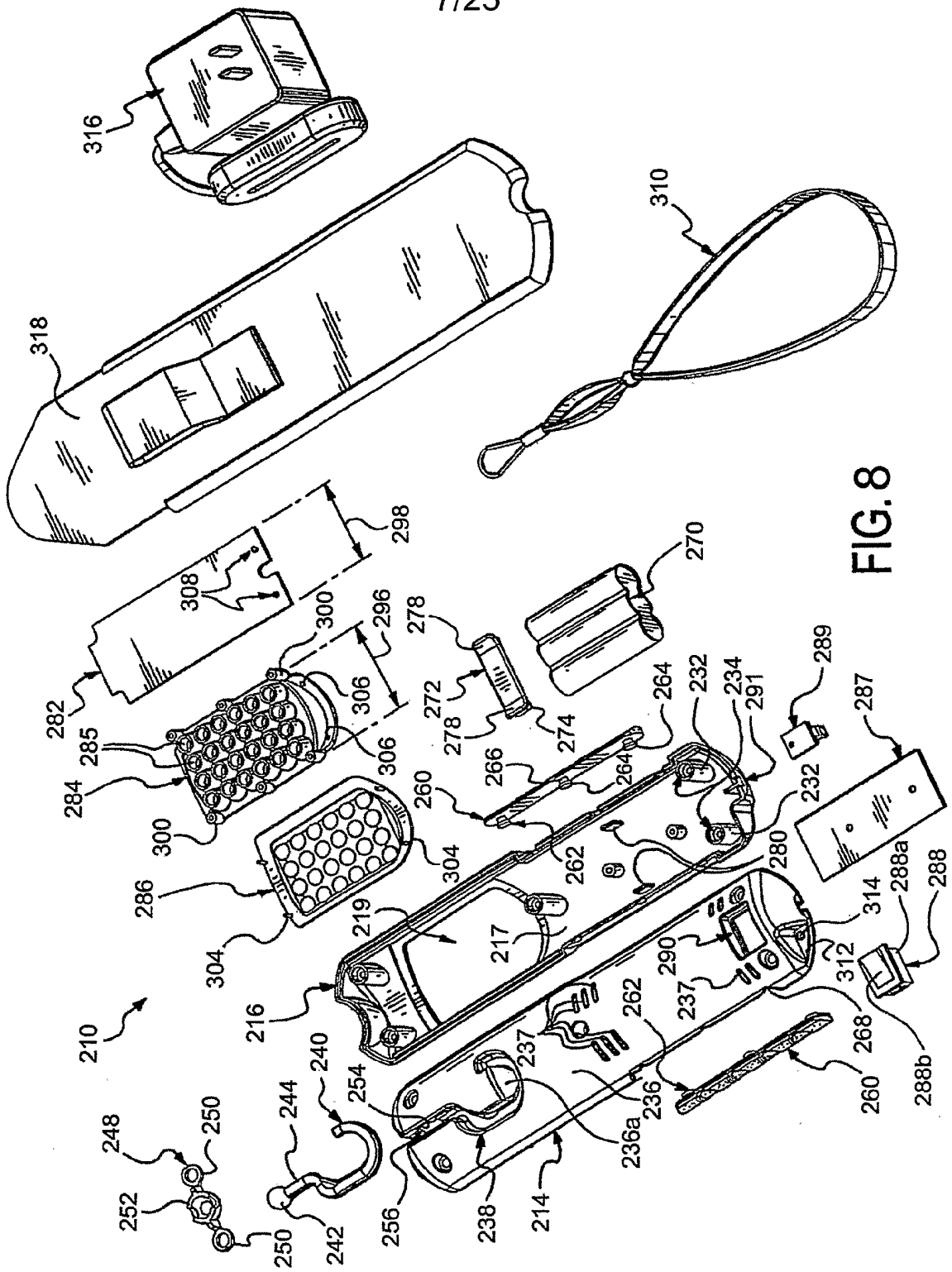
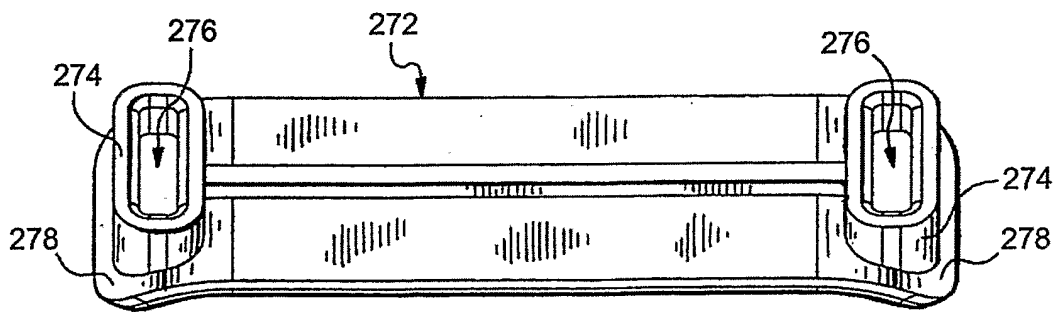
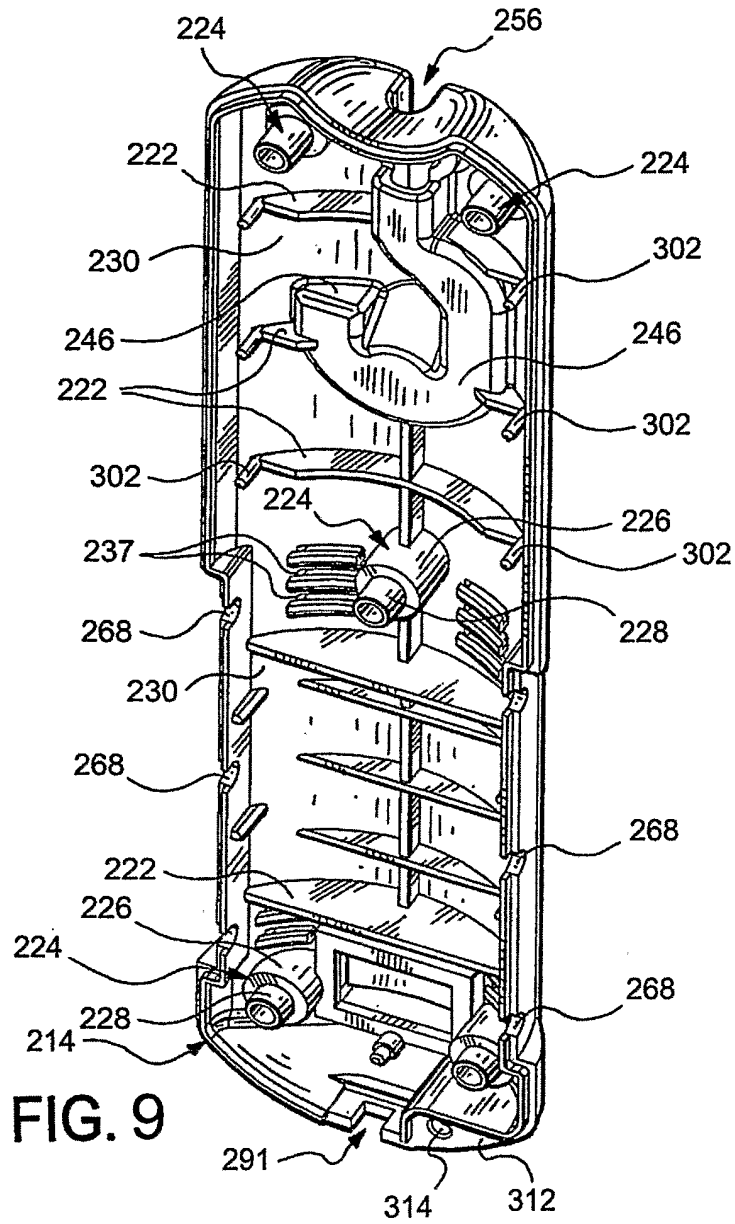


FIG. 8

8/25



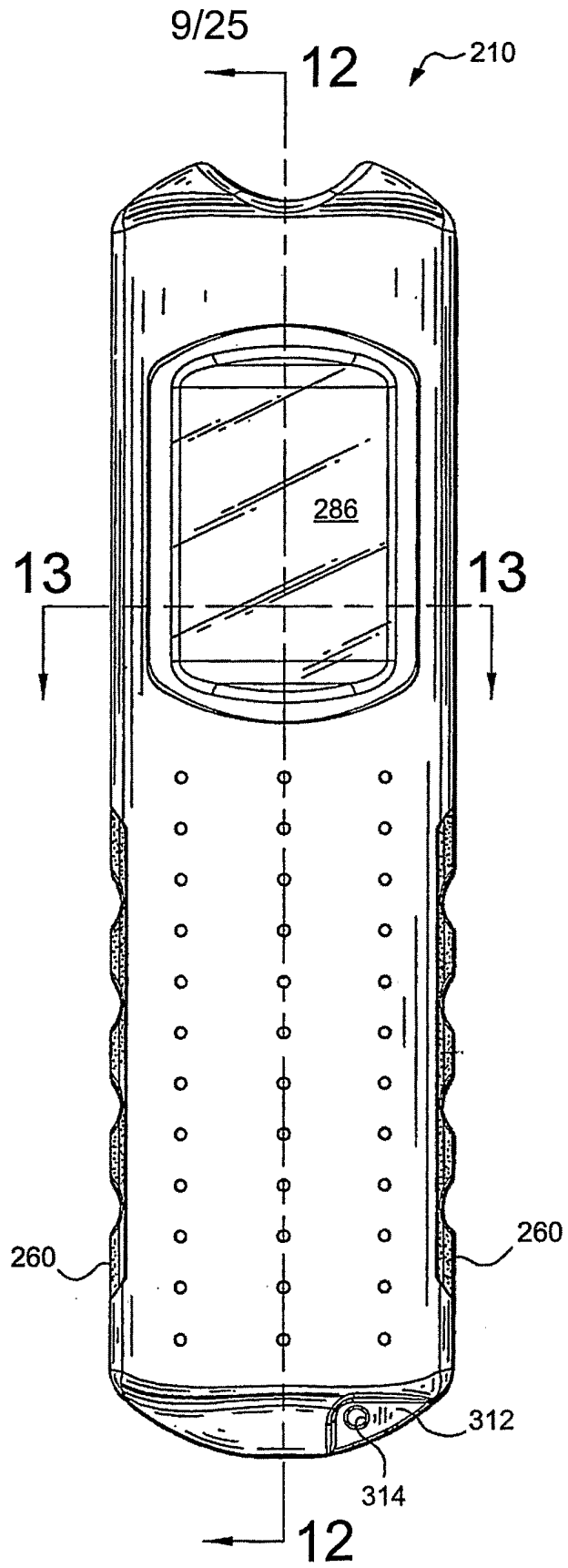


FIG. 11

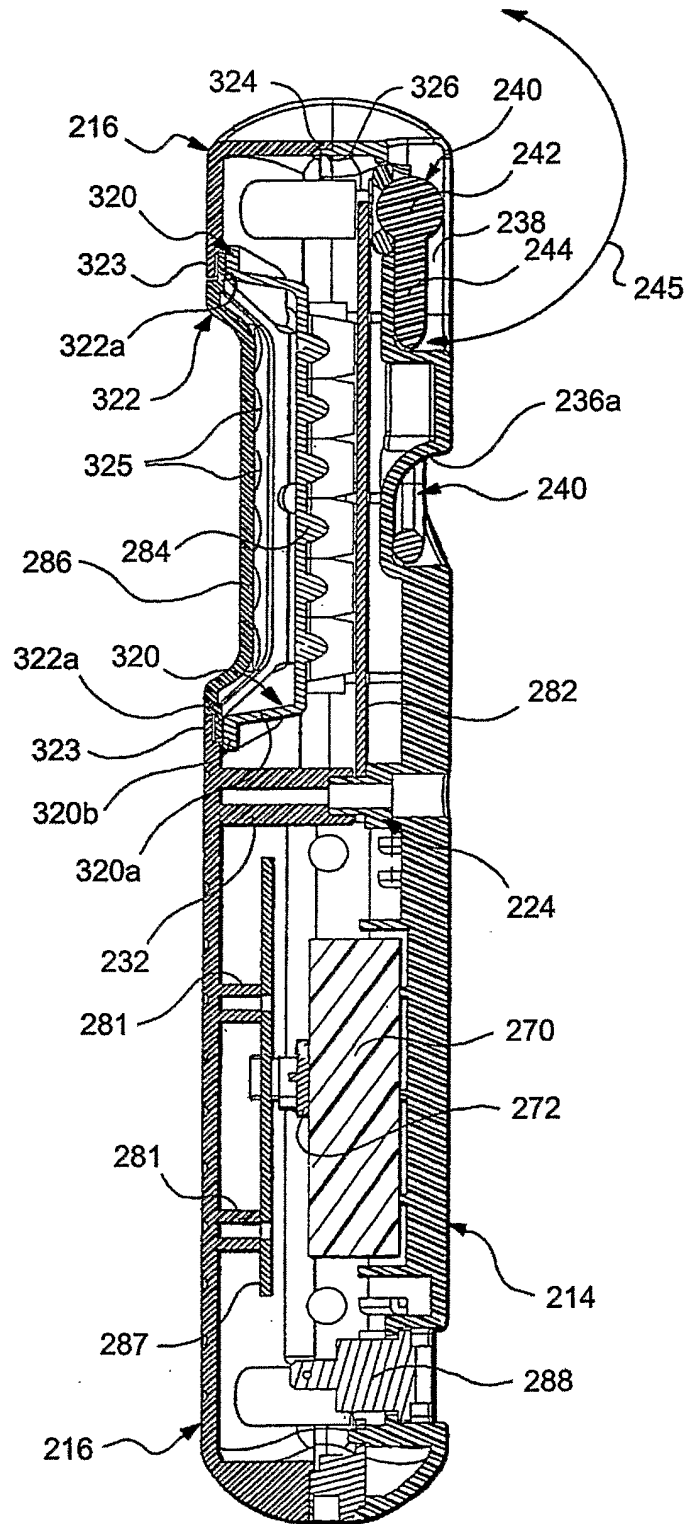


FIG. 12



Fig. 15

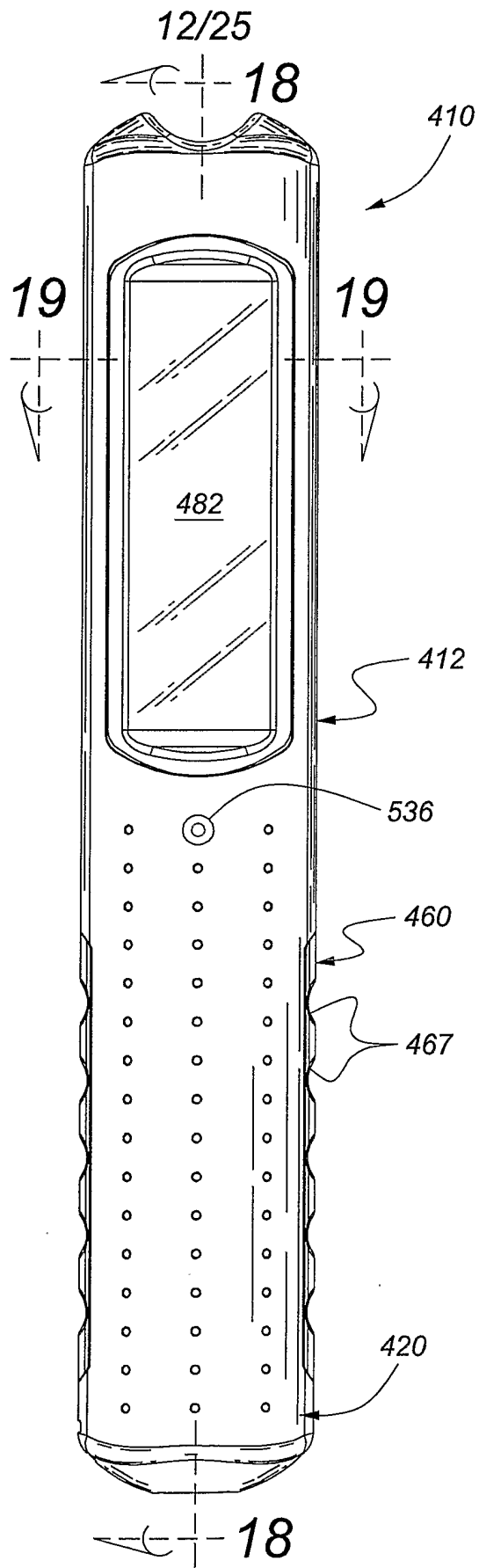




Fig. 17a

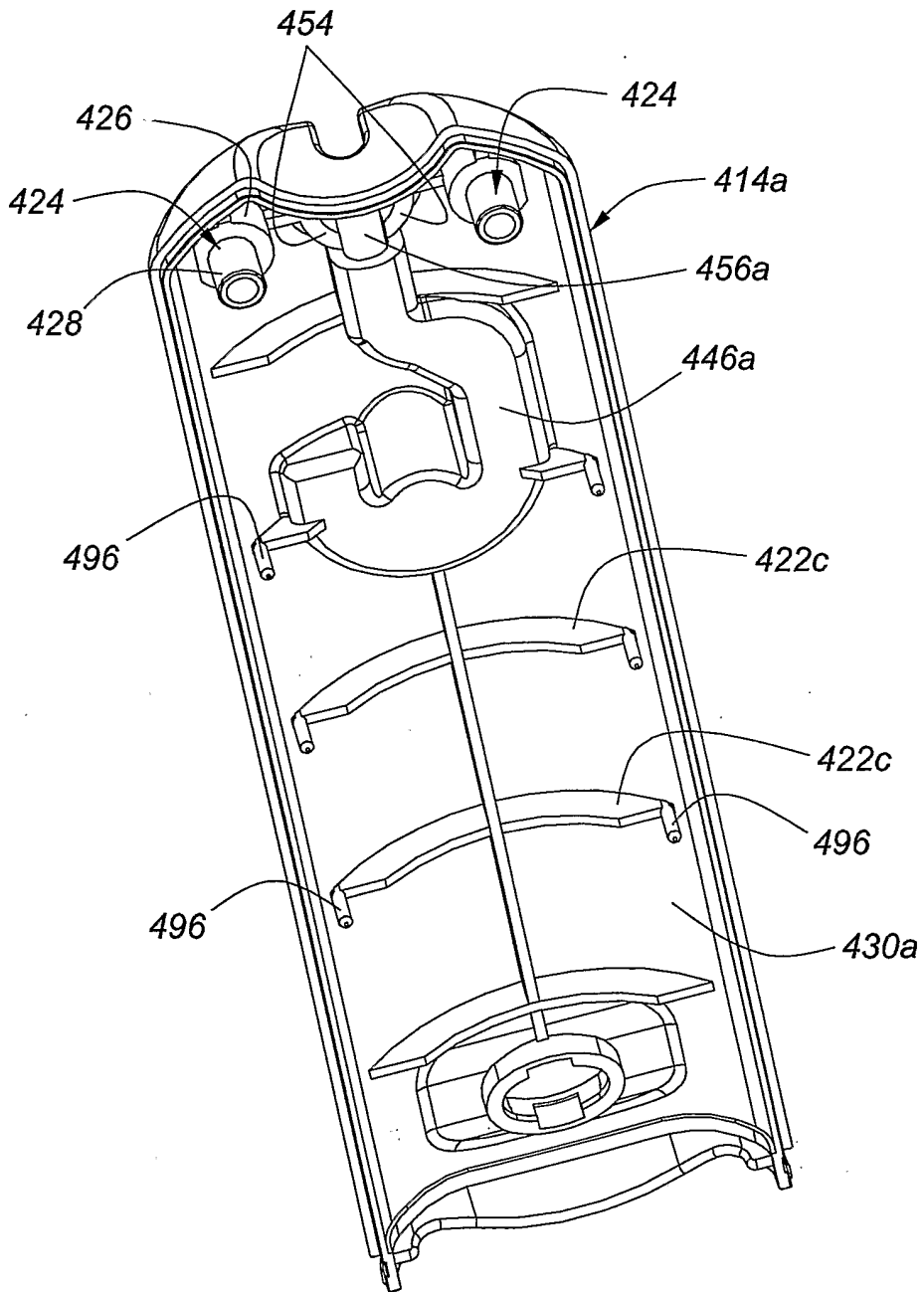
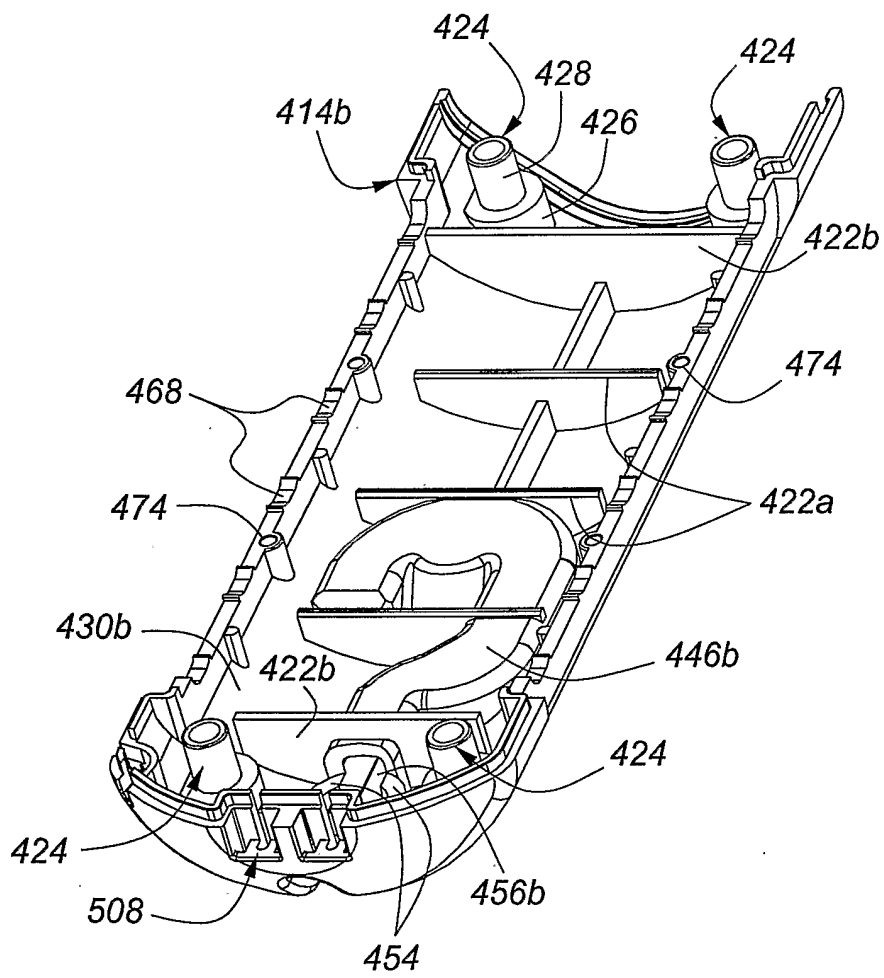
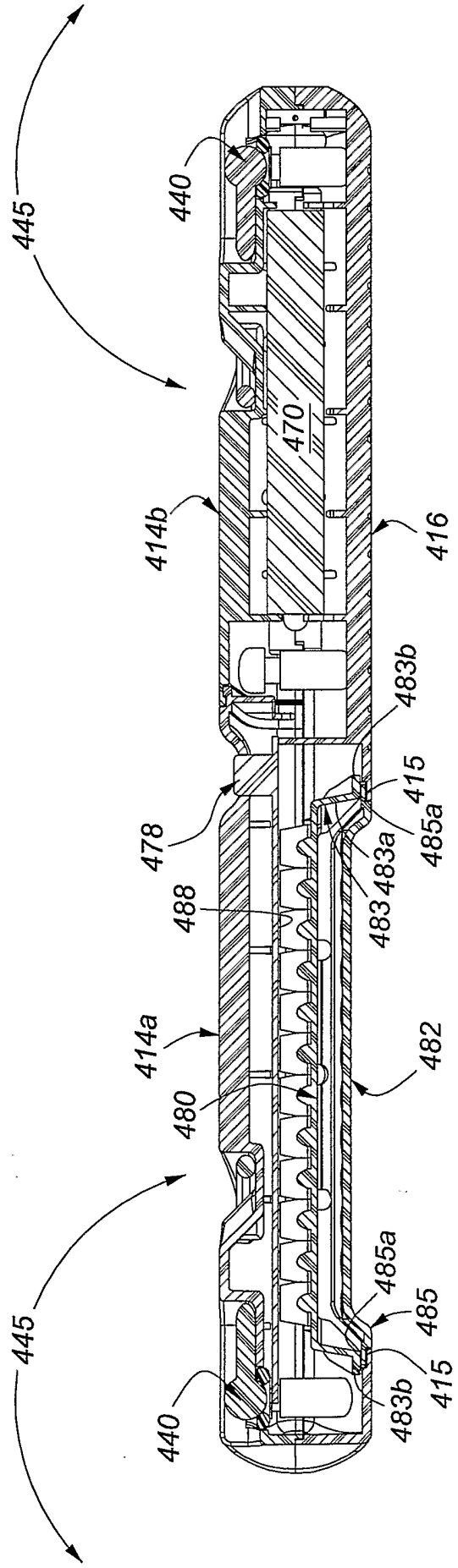


Fig. 17b



16/25

Fig. 18



17/25

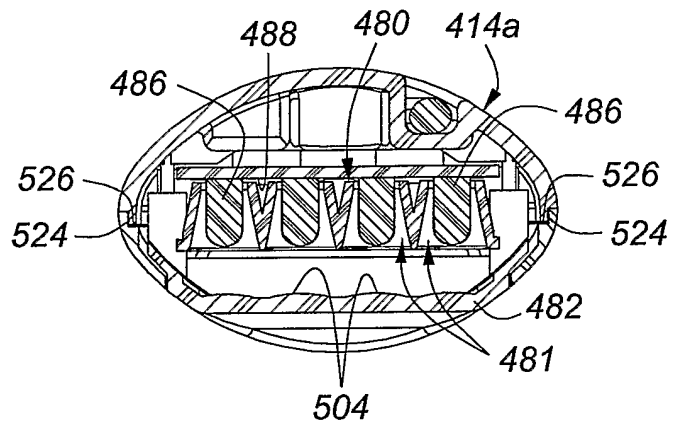


Fig. 19

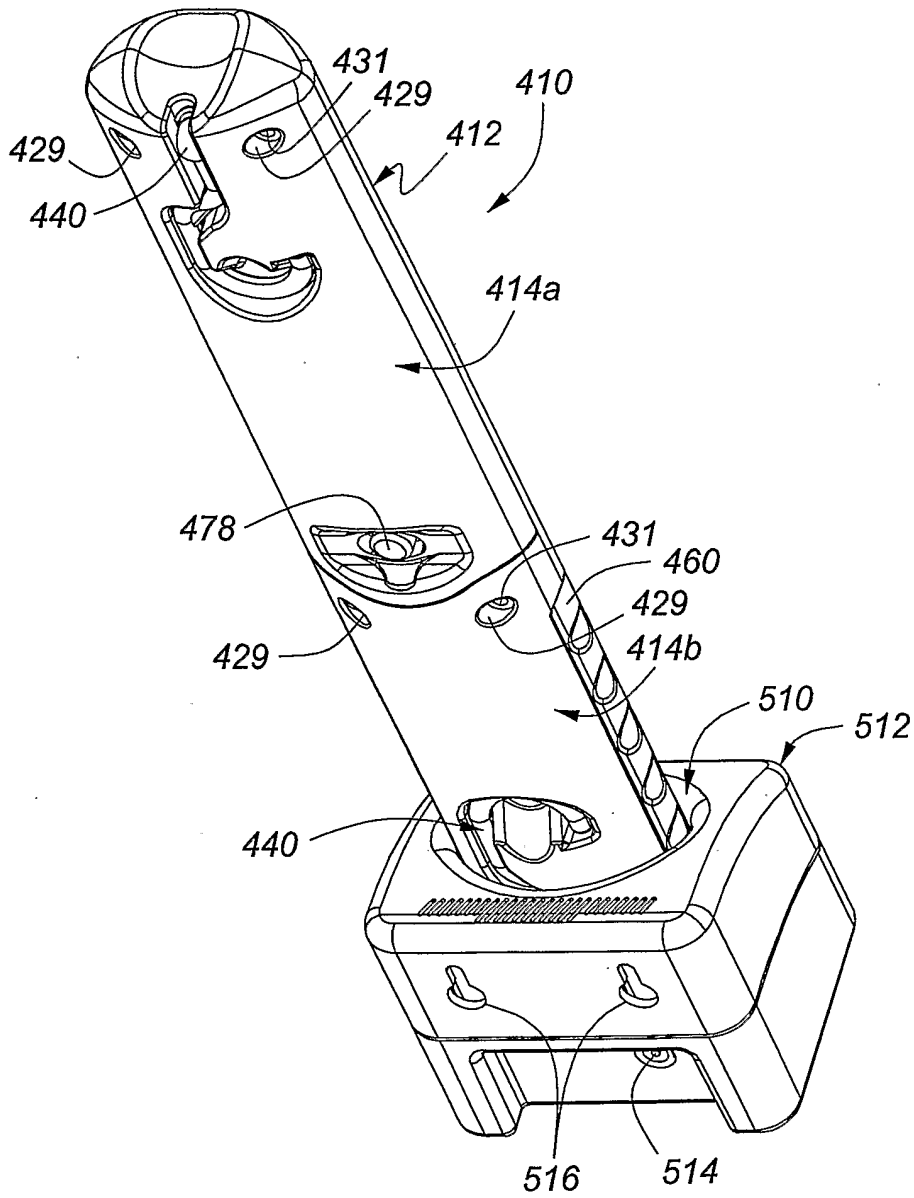


Fig. 20

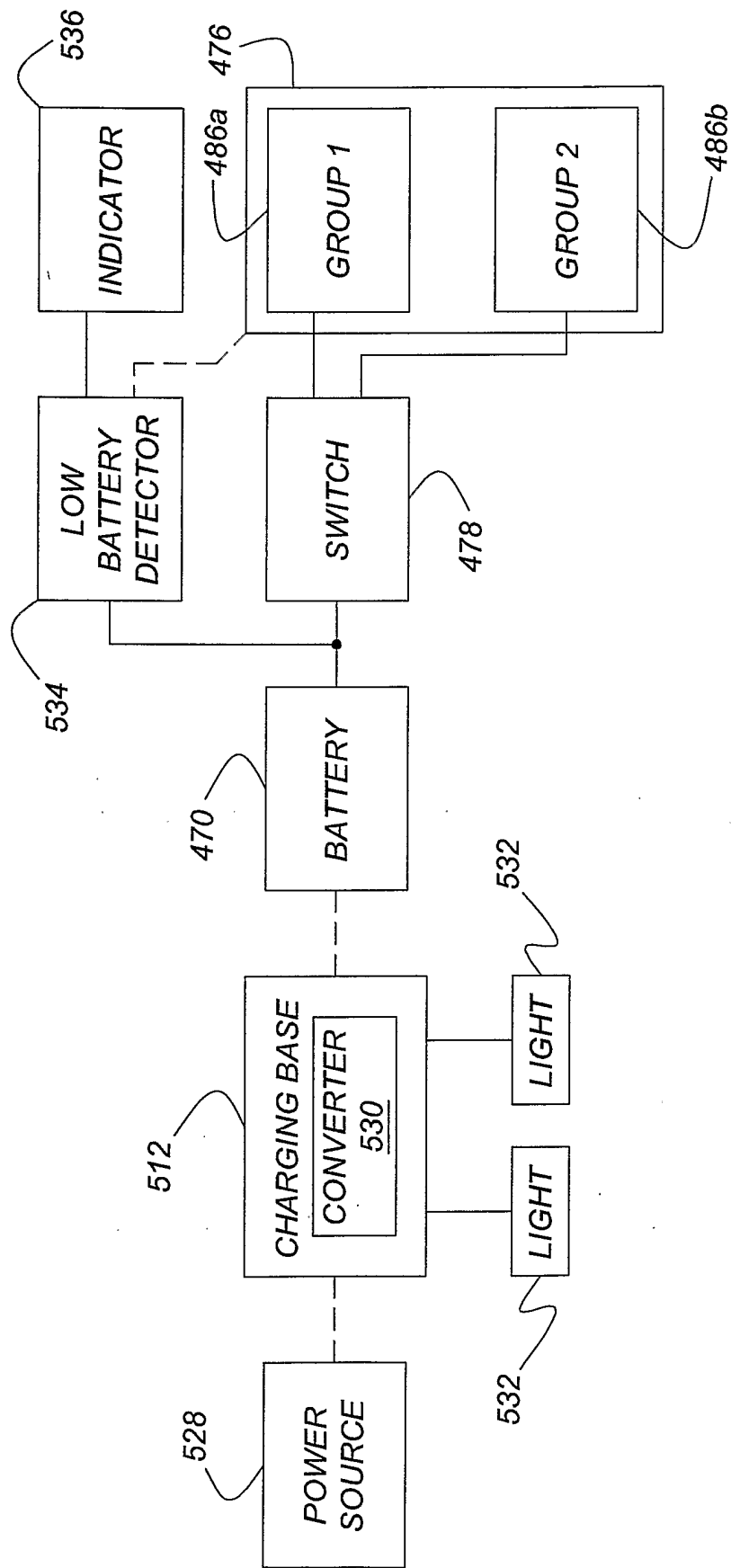


Fig. 21

Fig. 22

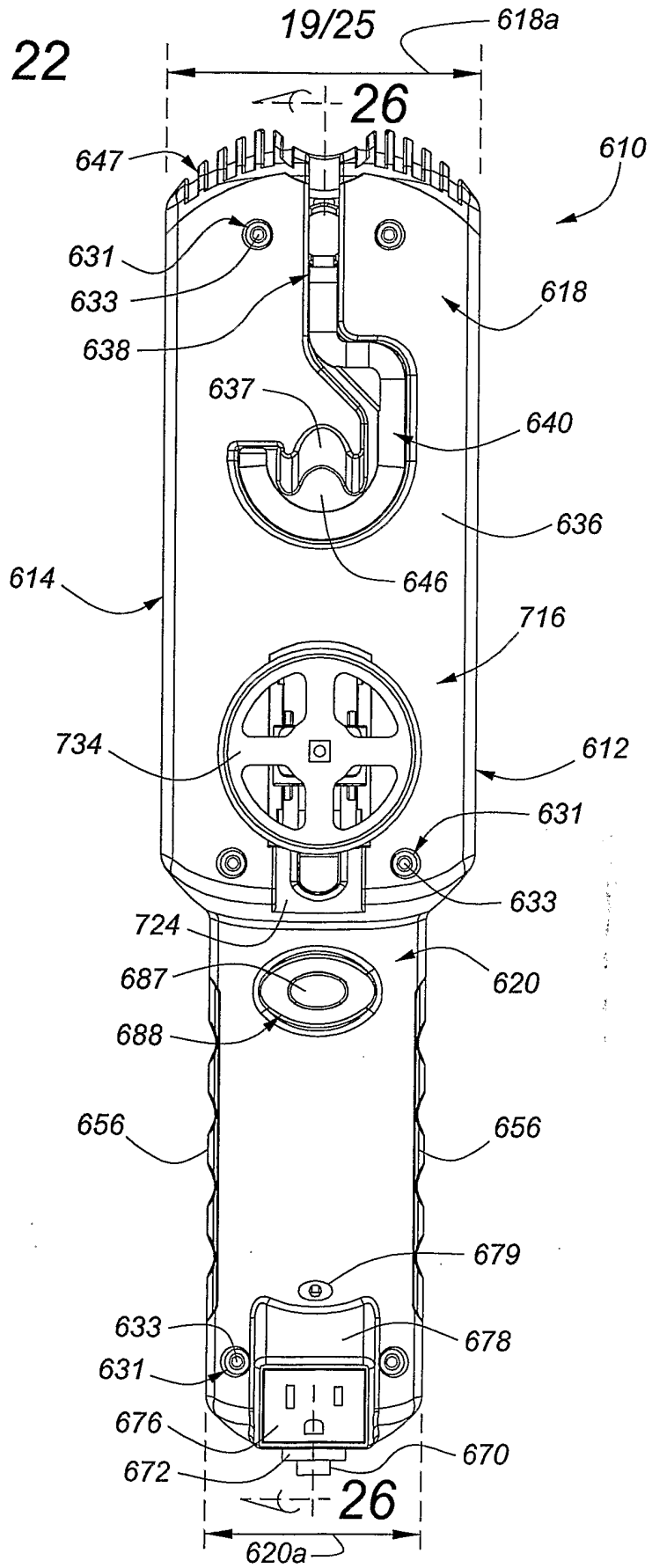


Fig. 23

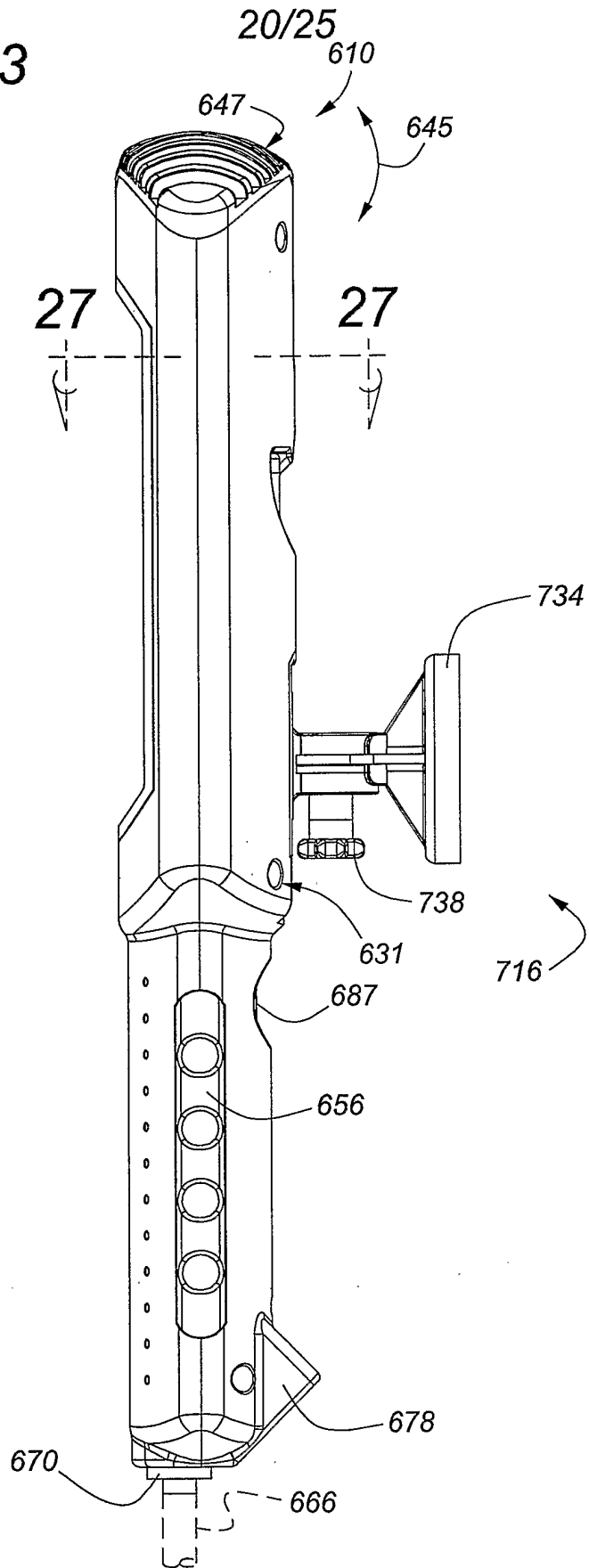




Fig. 25

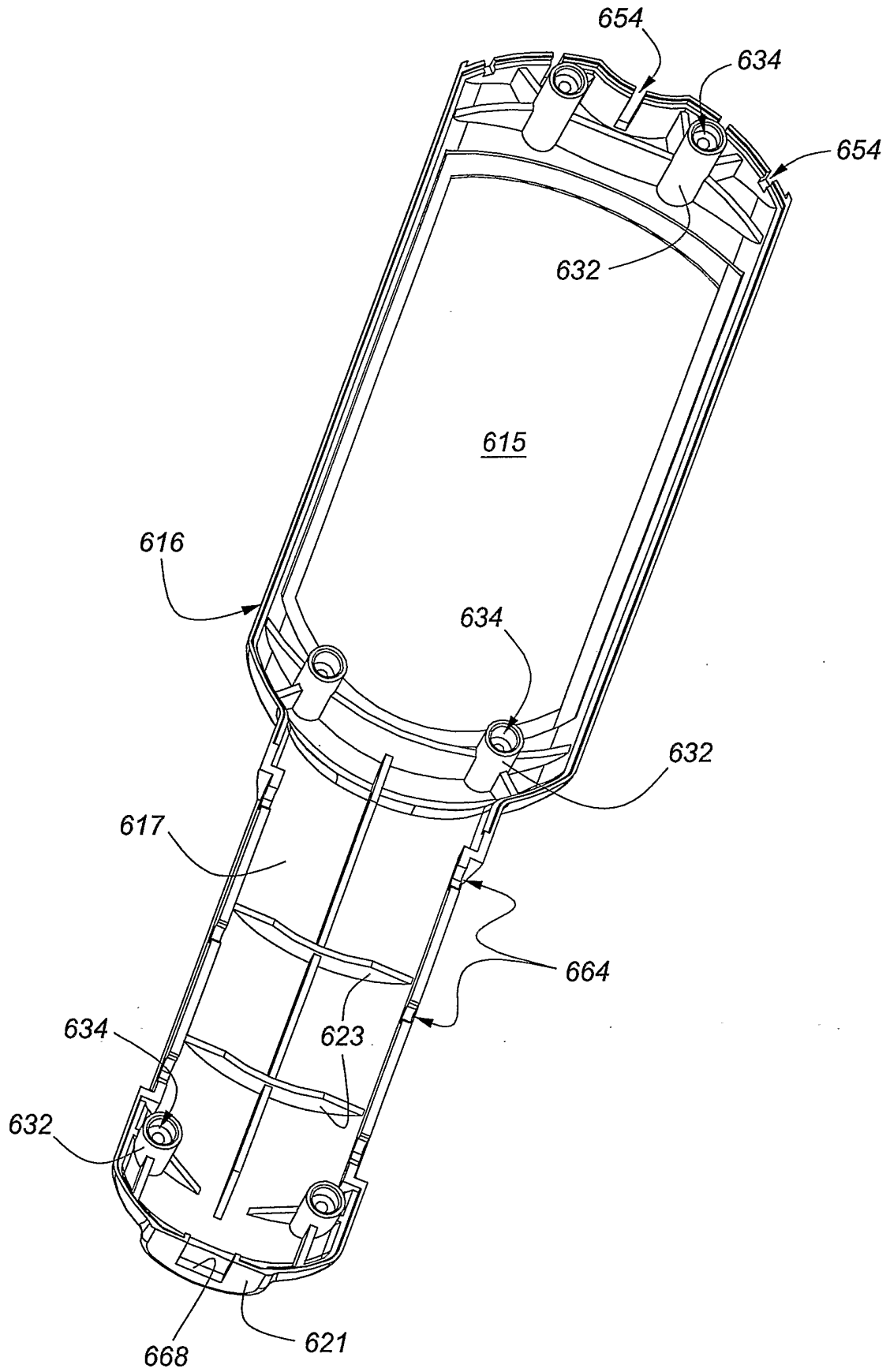


Fig. 26

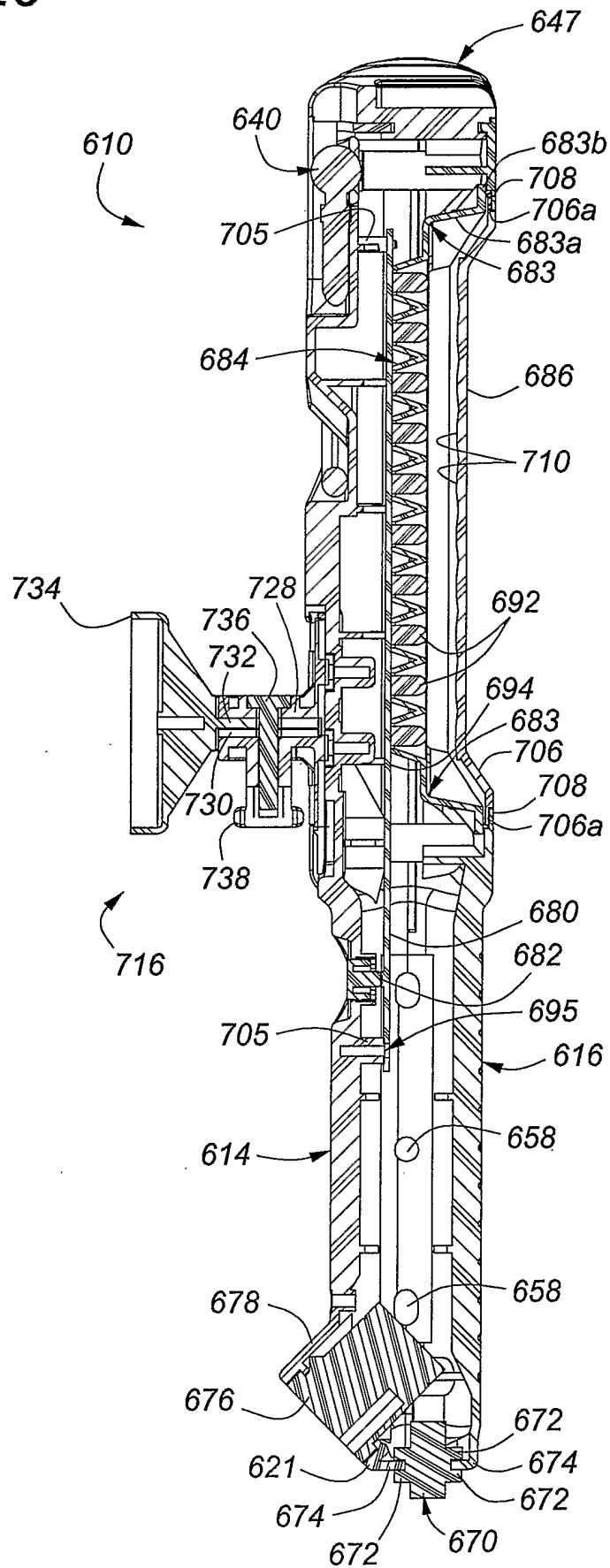


Fig. 27

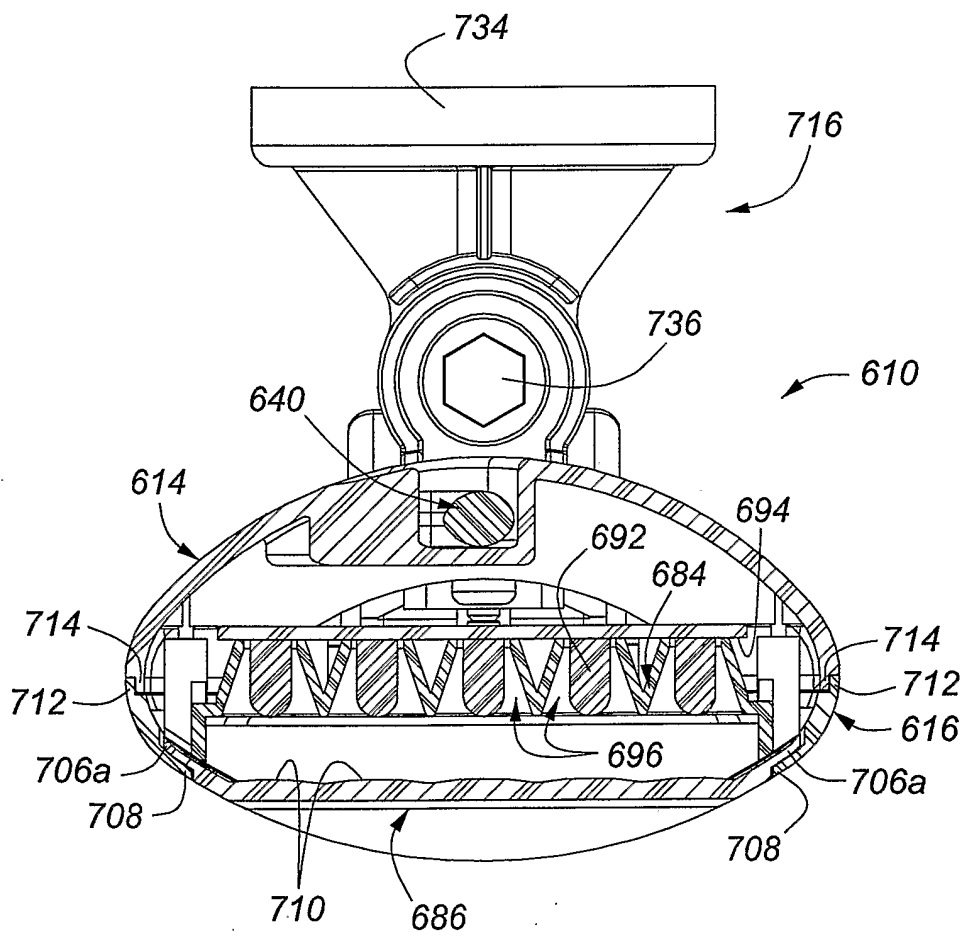
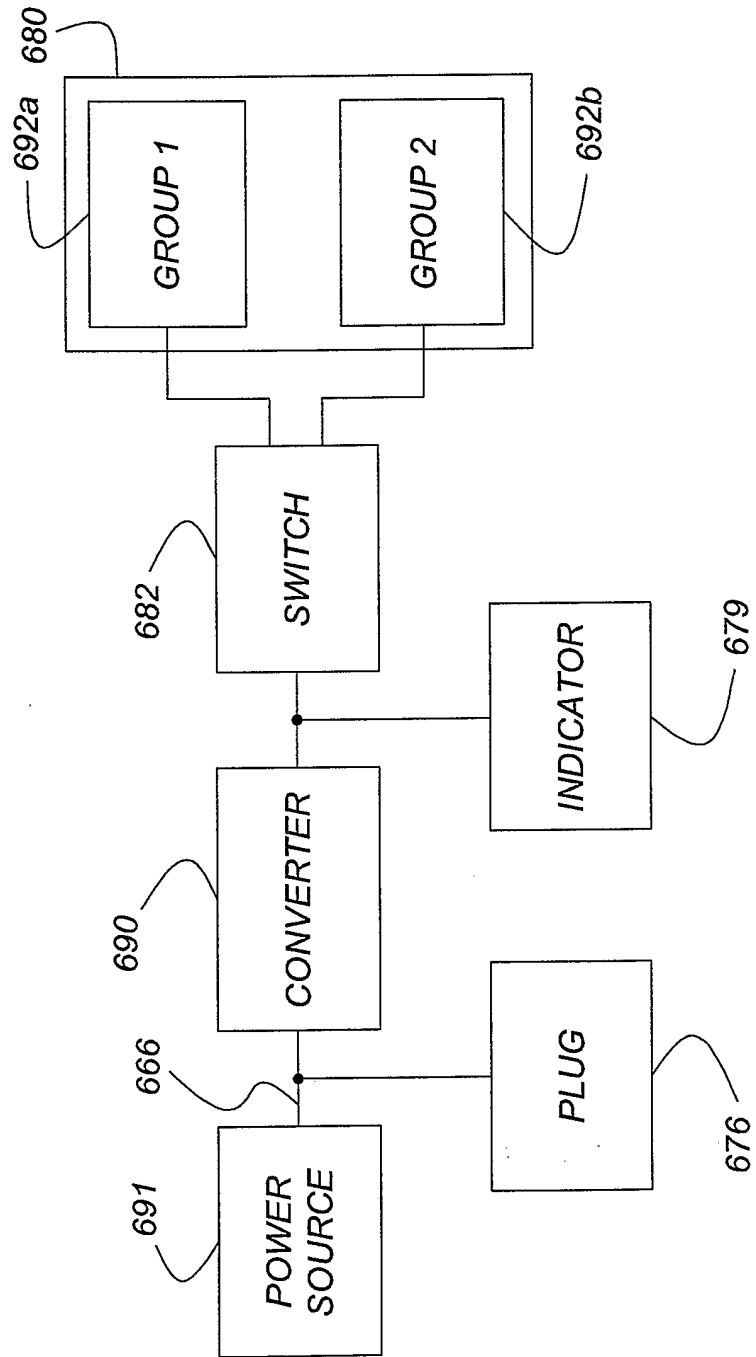


Fig. 28



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/US2005/028372

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 198 02 998 A1 (AMIN-AMER, MANSOUR, 83533 EDLING, DE) 27 August 1998 (1998-08-27) column 2, line 13 - column 5, line 63; figures 1-3	12
X	----- US 2003/039121 A1 (NEZIGANE FUMIYOSHI) 27 February 2003 (2003-02-27) paragraph '0009! - paragraphs '0171!, '0002!; figures 1,2 -----	19

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No  
PCT/US2005/028372

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0203761	A	10-01-2002	AU 7756301 A EP 1297723 A1 FR 2811194 A1	14-01-2002 02-04-2003 04-01-2002
DE 20317017	U1	19-02-2004	NONE	
DE 19802998	A1	27-08-1998	NONE	
US 2003039121	A1	27-02-2003	NONE	