

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
20 September 2001 (20.09.2001)

PCT

(10) International Publication Number  
WO 01/69123 A1

(51) International Patent Classification<sup>7</sup>: F21S 8/00, F21V 17/04, 11/08, 13/10, 25/02

(74) Agents: VOLPE, Anthony, S. et al.; Volpe and Koenig, P.C., Suite 400, One Penn Center, 1617 John F. Kennedy Boulevard, Philadelphia, PA 19103 (US).

(21) International Application Number: PCT/US01/07566

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(22) International Filing Date: 9 March 2001 (09.03.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/188,420 10 March 2000 (10.03.2000) US  
09/695,805 25 October 2000 (25.10.2000) US

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

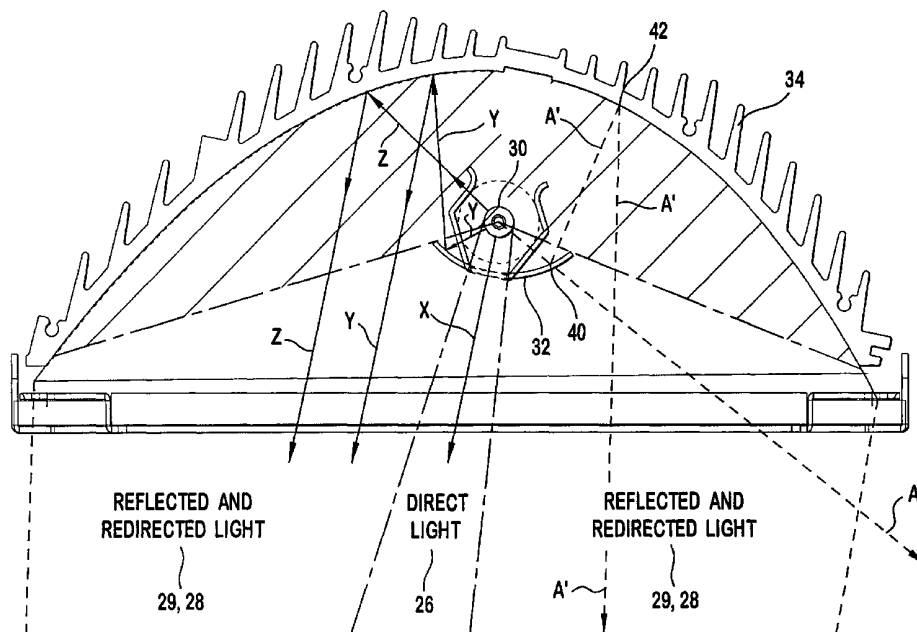
(71) Applicant: ACCU-SORT SYSTEMS, INC. [US/US];  
511 School House Road, Telford, PA 18969-1196 (US).

Published:  
— with international search report

(72) Inventors: HECHT, Kurt; 1474 Old York Road, Hartsville, PA 18974 (US). BEIDEMAN, Robert, Michael; 166 Rickerts Road, Barn #1, Doylestown, PA 18901 (US). VEKSLAND, Michael; 204 Bayberry Court, Marlton, NJ 08053 (US).

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.

(54) Title: HIGH EFFICIENCY ILLUMINATION SYSTEM INCORPORATING LAMP SAFETY REFLECTOR



(57) Abstract: A system (16) for illuminating a desired illumination region comprises a lamp (30) for providing illumination, a reflector (34) for reflecting a portion of the illumination towards said desired illumination region and a shield (32), selectively positioned between the lamp and the desired illumination region. The shield permits a portion of the illumination to pass directly from the lamp to the desired illumination region and redirects another portion of the illumination toward the reflector.



WO 01/69123 A1

## HIGH EFFICIENCY ILLUMINATION SYSTEM INCORPORATING LAMP SAFETY REFLECTOR

This application claims the benefit of U.S. Provisional Application No. 60/188,420 filed on March 10, 2000.

5

### BACKGROUND

The present invention generally relates to an apparatus for illuminating coded information symbols. More particularly, the present invention relates to an illumination system which selectively reflects and redirects illumination towards a working area and also includes a safety shield to disperse energy in the event of a lamp rupture.

10 Erroneous imaging of human or machine readable symbologies often results from many different factors. However, a primary cause of erroneous imaging is poor lighting conditions. Proper illumination is one of the most important requirements for any machine imaging system. The illumination of an object or a label thereupon is particularly critical for high speed scanning systems that employ image sensors, such as  
15 CCD or CMOS detectors. The ability of an image-based scanning system to accurately detect an object depends upon the amount of light that is reflected from the region of illumination onto the image sensor. The amount of light detected by the image sensor is a function of both the integration period and the intensity of illumination.

Many current imaging systems include variable speed conveyors, wherein the  
20 conveyor speed varies with the volume of packages handled by the system. If a low intensity illumination level is selected for low speed conveyor operation, the same illumination level may be insufficient for accurate imaging when the conveyor speed is increased. If a high intensity illumination level is selected, the light may saturate the image sensor when the conveyor is operating at low speeds.

25 High intensity illumination sources have also been known to generate intense glare around the operating region of the scanning system. This creates an annoyance and a safety hazard to personnel operating in the vicinity of the scanning system. Additionally, high intensity illumination systems have bulbs which may catastrophically fail, (i.e.

explode), thereby creating an additional safety hazard to personnel due to flying glass and debris.

Accordingly, there exists a need for an illumination assembly which specifically directs illumination over a working depth of field and which minimizes the hazards to personnel operating in the vicinity of the scanning system.

## SUMMARY

An apparatus for illuminating coded information symbols is provided with an elliptical safety reflector which includes a shield mounted between a lamp and the desired region of illumination. The shield includes a cut-out for permitting illumination to pass directly from the bulb to the desired region of illumination. The shield also redirects a portion of the light which would otherwise illuminate areas outside the desired region of illumination and reflects the light back to the front surface of the elliptical reflector to be distributed as defined by the shape of the reflector surface. The shield also acts as a safety shield to selectively direct energy should the lamp explode.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a high speed imaging apparatus made in accordance with the present invention.

Figure 2 is an illumination assembly made in accordance with the present invention.

Figure 3A is a perspective view of the shield made in accordance with the present invention.

Figure 3B is a perspective view of an alternative embodiment of a shield made in accordance with the present invention.

Figure 3C is a perspective view of a second alternative embodiment of a shield made in accordance with the present invention.

Figure 4A is a perspective view of a dual socket lamp.

Figure 4B is a perspective view of a mogul-based single socket lamp.

Figure 5 is a fragmentary perspective view of the clamp of a shield attached to an electric socket.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

The preferred embodiment will be described with reference to the drawing figures where like numerals represent like elements throughout. A high speed imaging apparatus 12 is shown in Figure 1. The imaging apparatus 12 comprises an imager 14 and an illumination assembly 16. The imaging apparatus 12 is typically held in place above a conveyor 18 by a frame or housing 10. As a package 20 travels along the conveyor 18 it passes under the imaging apparatus 12. The package 20 is illuminated to facilitate the detection of the package 20 and any human or machine readable symbologies located thereon, such as a bar code 22. For simplicity, the invention will be described with reference to the illumination and detection of bar codes. However, the present invention is applicable to any type of system for imaging objects or imaging human or machine readable symbologies.

There are many factors which can affect the ability of the apparatus 12 to accurately detect each bar code label 22, including the speed of the conveyor 18, the illumination intensity and the ability of the apparatus 12 to accurately focus on the subject bar code label 22. The present invention is directed to the problem of proper illumination.

In accordance with the present invention, the desired illumination region 24 is known to include all regions of interest over a specified width and depth, (or height). As shown in Figure 1, the illumination is directed over a working depth 24 (or desired illumination region) which is illuminated with three different "sources" of light: 1) direct light 26; 2) redirected light 28; and 3) reflected light 29. These three sources of light 26, 28, 29 will be defined with reference to Figure 2.

Referring to Figure 2, the direct light 26 emanates from the elongated lamp 30 directly toward the desired illumination region 24. The direct light 26 comprises only light which emanates directly from the lamp 30, as illustrated by light beam X. Redirected light 28 comprises light that has been redirected from the shield 32 toward the reflector 34 and then toward the desired illumination region 24, as illustrated by light

beam Y. Reflected light 29 comprises light that emanates from the lamp 30 toward the reflector 34, and is reflected by the reflector 34 toward the desired illumination region 24, as illustrated by light beam Z.

As shown in Figure 2, the illumination assembly 16 includes the reflector 34 and the shield 32, which work in cooperative arrangement with the lamp 30. The shield 32 provides two separate functions. The first function is to block light from the lamp 30 which would illuminate areas other than the desired illumination region 24 and redirect the light toward the desired illumination region 24. For example, dotted line A represents a beam of light which, in the absence of the shield 32, would emanate from the lamp 30 but would not illuminate the desired illumination region 24, since this light beam A is directed outside that area. It is this type of light which would become an annoyance and safety hazard to employees operating in the vicinity of the imaging apparatus 12. In accordance with the present invention, the light beam A' is reflected off of the shield 32 at point 40 toward the reflector 34. The light beam A' is then reflected by the reflector 34 at point 42 toward the desired illumination region 24 as redirected light 28. As shown, the shield 32 not only eliminates light beam A from outlying areas which would otherwise be an annoyance and safety hazard to employees, it redirects this light A' over the desired illumination region 24. Accordingly, the effective efficiency of the lamp 30 is thereby increased. This permits a greater accuracy in symbology scanning or may even permit a reduction in the power of the lamp 30.

A second function of the shield 32 is to act as a safety shield to disperse energy should the lamp explode. Shields made in accordance with the present invention are shown in Figures 3A-C. Each shield 32 includes a body 50, a cut-out 52 and one or more clamps 54, (each clamp 54 including a pair of arms 56), extending either from a flange 58 or the body 50 itself. The flanges 58 keep the clamps 54 in operative alignment with the body 50. Preferably, the body 50 is made of a reflective material, or coated with a reflective material, such that stray illumination as illustrated by light beam A will be eliminated and will instead be reflected as light beam A' from the body 50 toward the reflector 34, (shown in Figure 2). Direct light 26 from the lamp 30 is permitted to exit the cut-out 52 and directly illuminate the desired illumination region 24.

As should be understood by those of skill in the art, if an elongated lamp 30 having dual sockets is used, as shown in Figure 4A, the lamp 30 is inserted into and powered by a pair of electric sockets 60, 61. As shown in Figure 5, the clamps 54 attach onto the sockets 60, 61 and are securely held by arms 56 onto the sockets 60, 61. Figure 5 further shows that the length of the flange 58 is a function of the socket design, such that the body 50 need only extend over the length of the lamp 30 and not the sockets 60, 61. Alternatively, as shown by Figure 3B, the body 50 may extend the entire length of the shield 32 up to the clamps 54. It should be understood by those skilled in the art that the present invention has been described with reference to an elongated lamp 30 with dual sockets 60, 61. However, if the present invention is used with a mogul-based single socket lamp, as shown in Figure 4B, the shield 32 of the present invention would be modified to permit such an arrangement. A modified shield 32 for an elongated mogul-based single socket lamp 30 is shown in Figure 3C. It is important to note that the shield 32 should be mounted such that the position of the lamp 30, the shield 32 and the reflector 34 will be maintained at all times such that the light will be properly directed, redirected or reflected toward the desired illumination region 24.

Although the invention has been described in part by making detailed reference to the preferred embodiment, such detail is intended to be instructive rather than restrictive. It will be appreciated by those skilled in the art that many variations may be made in the structure and mode of operation without departing from the spirit and scope of the invention as disclosed in the teachings herein.

\* \* \*

## CLAIMS

What is claimed is:

1. A system for illuminating a desired illumination region comprising:  
a lamp for providing illumination;  
a reflector for reflecting a portion of the illumination toward said desired illumination region; and  
5 a shield, selectively positioned between said lamp and said desired illumination region, for permitting a portion of the illumination to pass directly from the lamp to said desired illumination region and for redirecting another portion of the illumination toward said reflector.
2. The system of claim 1 whereby the shield further comprises a body and a selectively positioned cut-out, said body for performing said redirecting and said cut-out for permitting said portion of the illumination to pass directly from the lamp to said desired illumination region.
3. The system of claim 2 wherein the shield further comprises at least one clamp including a flange coupled to said body and a pair of arms extending from said flange, said flange keeping said at least one clamp in operative alignment with said body.
4. The system of claim 3 whereby at least a portion of said body is coated with a reflective material.
5. The system of claim 2 wherein said shield further comprises at least one pair of arms extending from said body.
6. The system of claim 1 whereby the lamp is an elongated dual socket lamp which is secured and powered by dual electric sockets.

7. The system of claim 1 whereby the lamp is mogul-based lamp which is secured and powered by a single electric socket.

8. A shield for use in an illumination system having a lamp and a reflector for reflecting a portion of said illumination toward an illumination region comprising:

a body for redirecting a portion of said illumination toward said reflector; said body having a cut-out for permitting a selected portion of said illumination to pass by said body without redirection or reflection; and

at least one clamp, for keeping the shield in operative alignment with the lamp.

9. The shield of claim 8 whereby at least a portion of the body is coated with a reflective material.

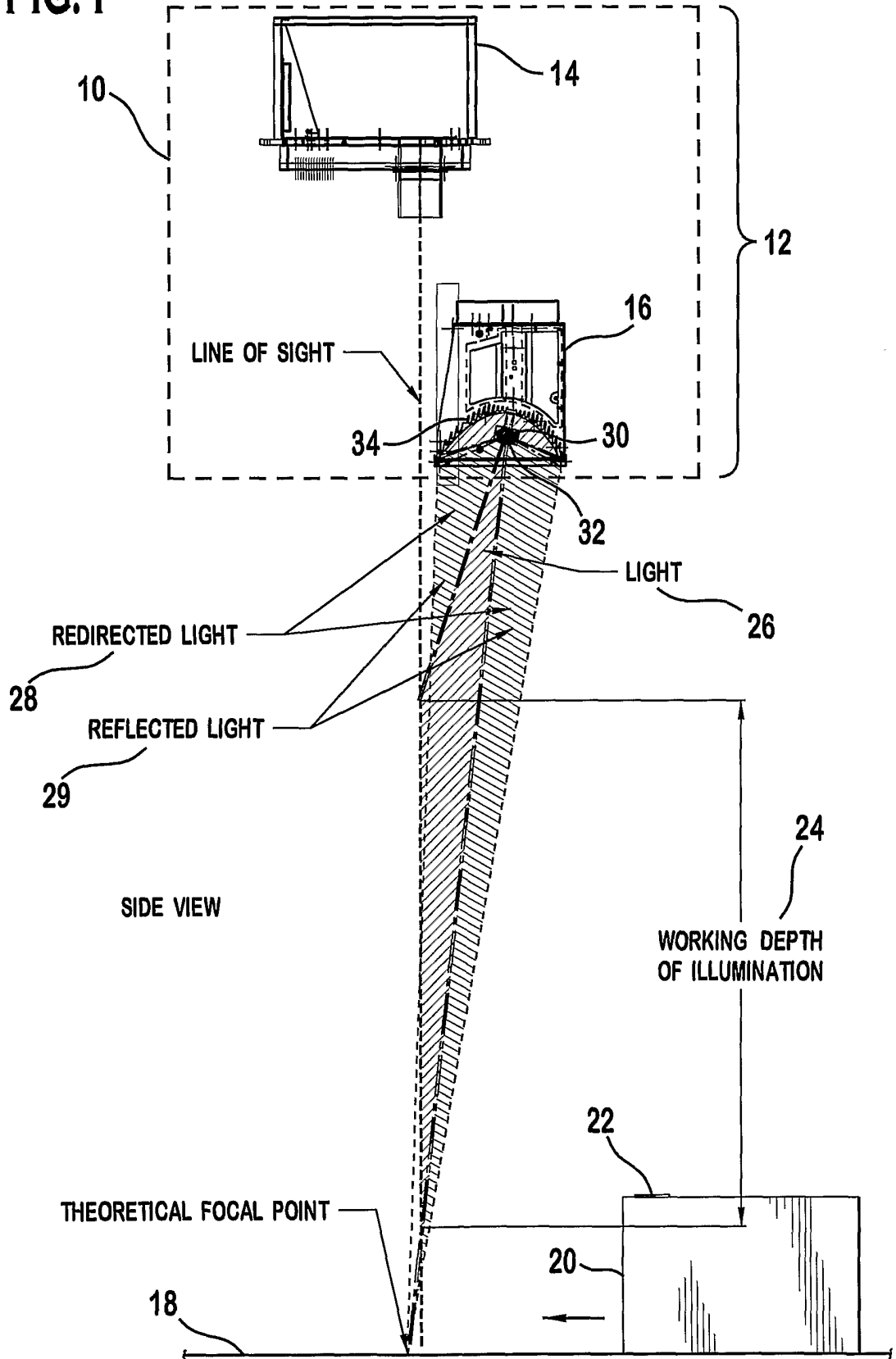
10. The shield of claim 9 whereby said clamp further includes a flange, for keeping said body in operative alignment with said clamp.

11. The system of claim 10 whereby the lamp is an elongated dual socket lamp which is secured and powered by dual electric sockets.

12. The system of claim 10 whereby the lamp is a mogul-based lamp which is secured and powered by single electric socket.

1 / 8

FIG. 1



2/8

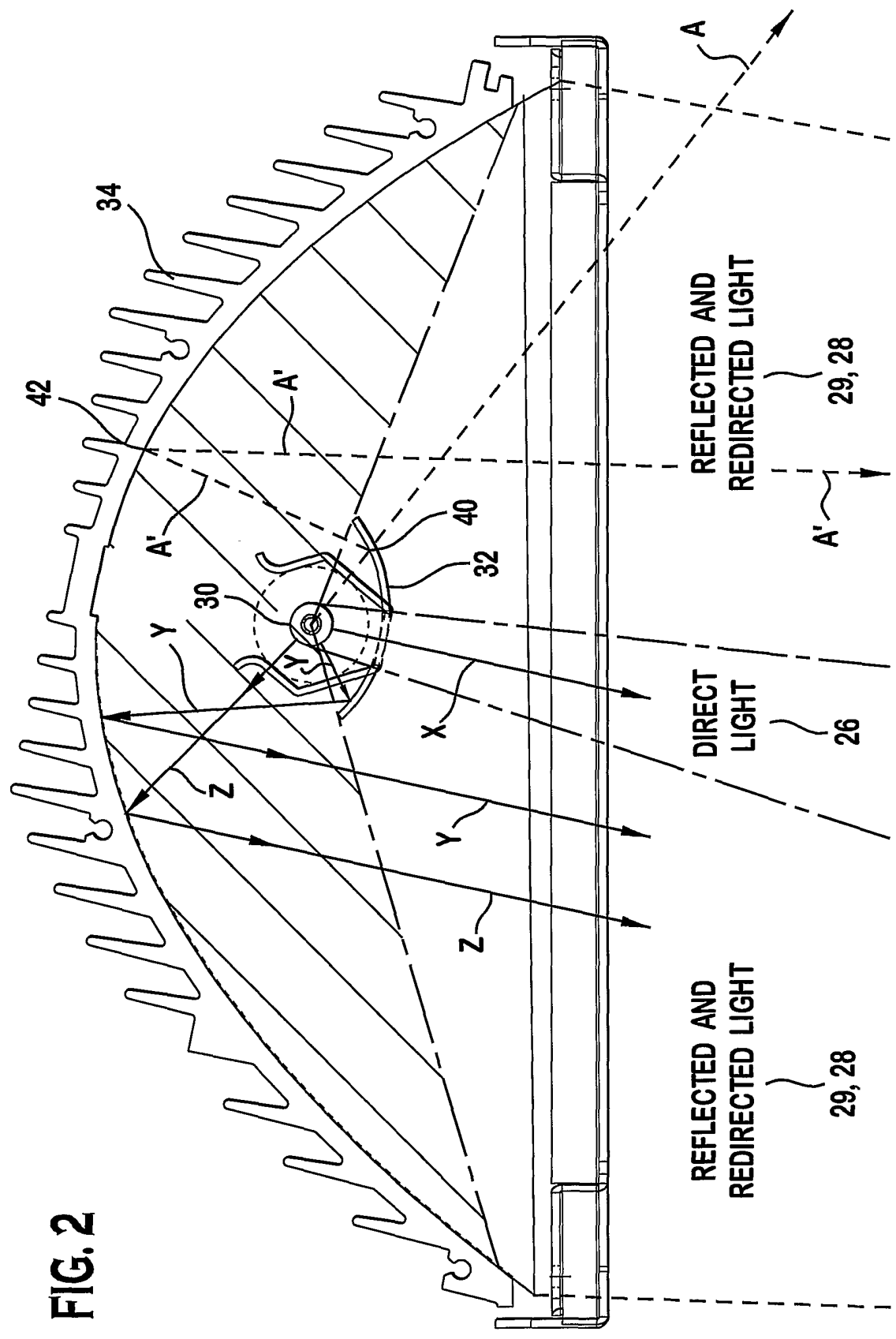


FIG. 2

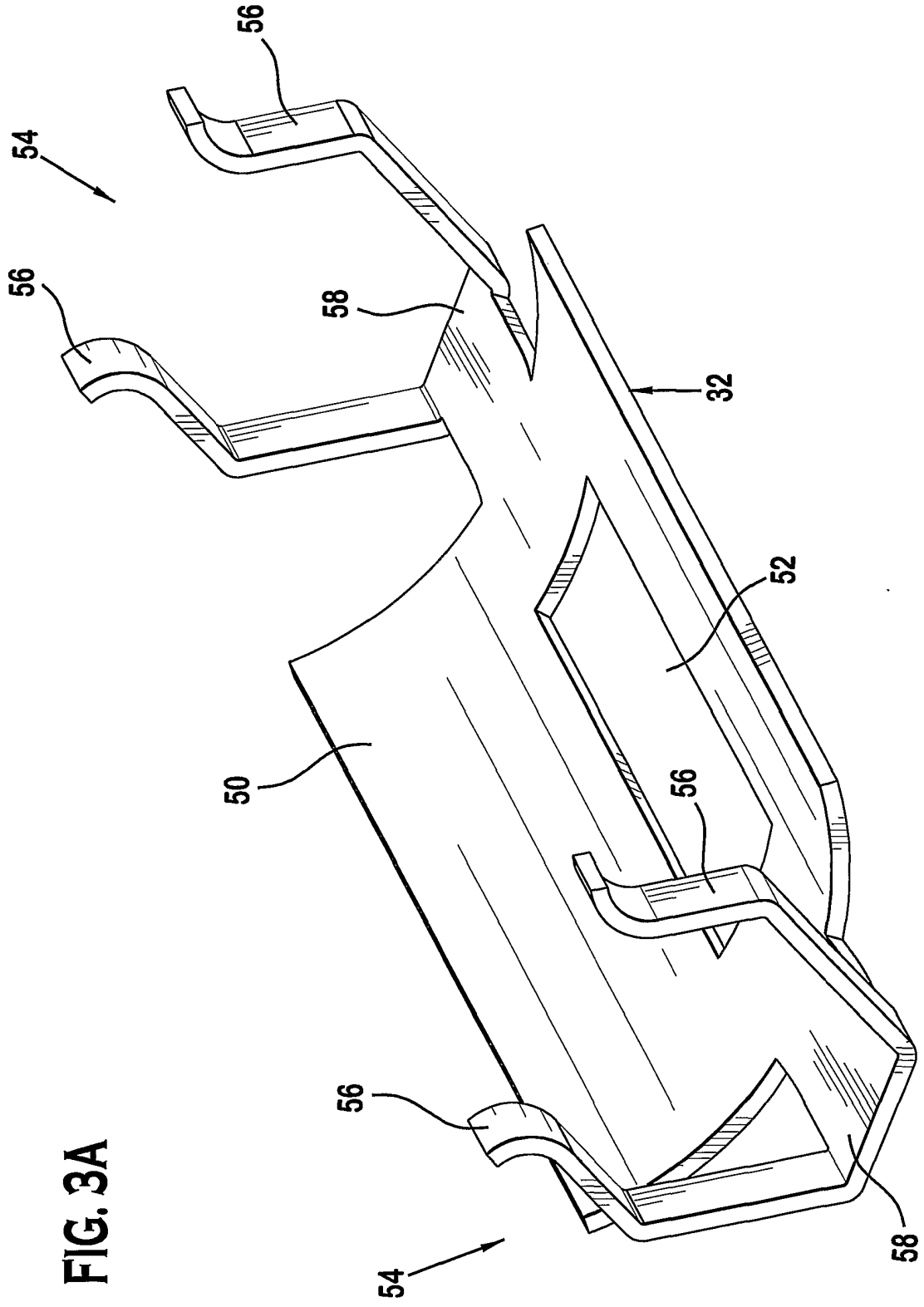


FIG. 3A

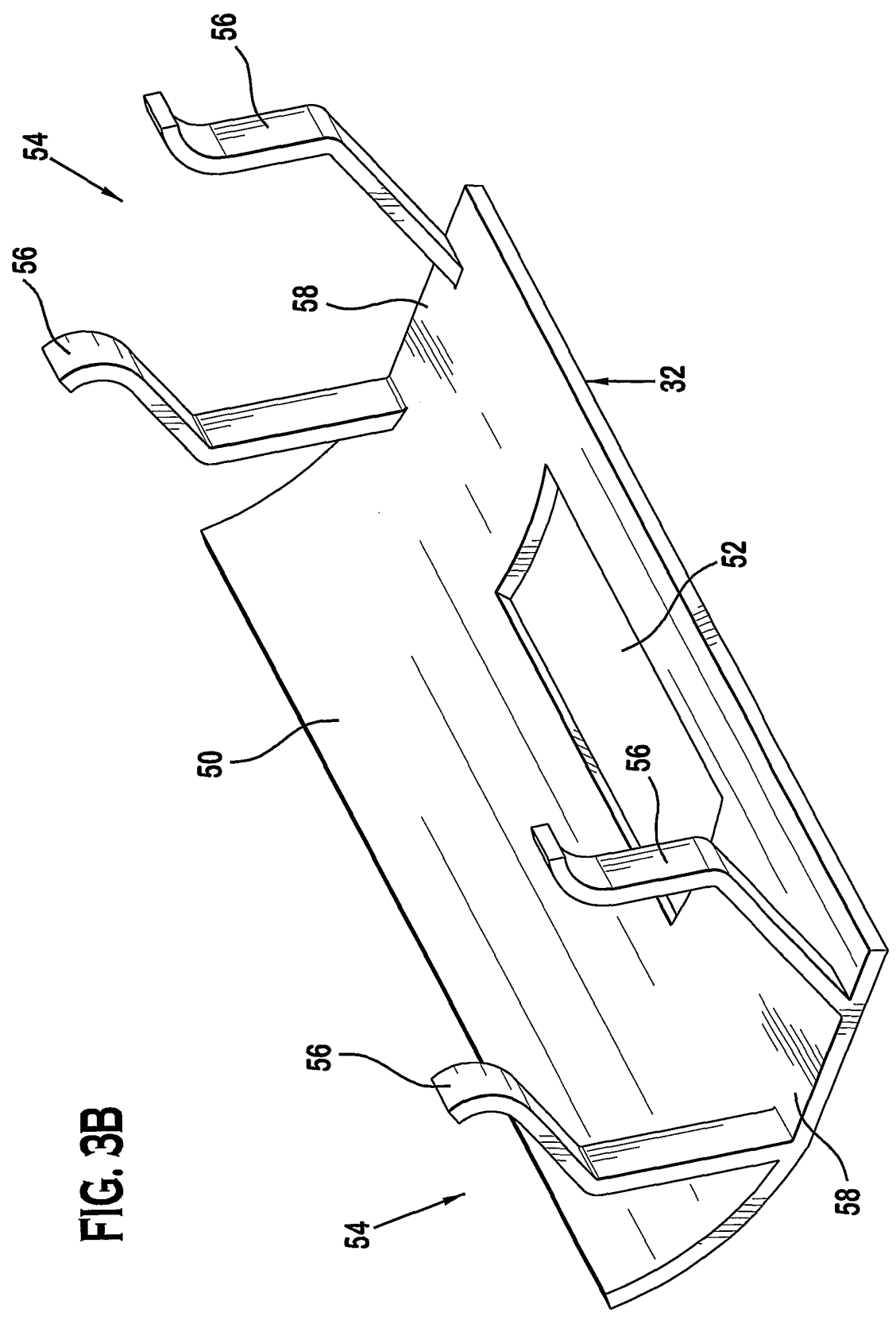
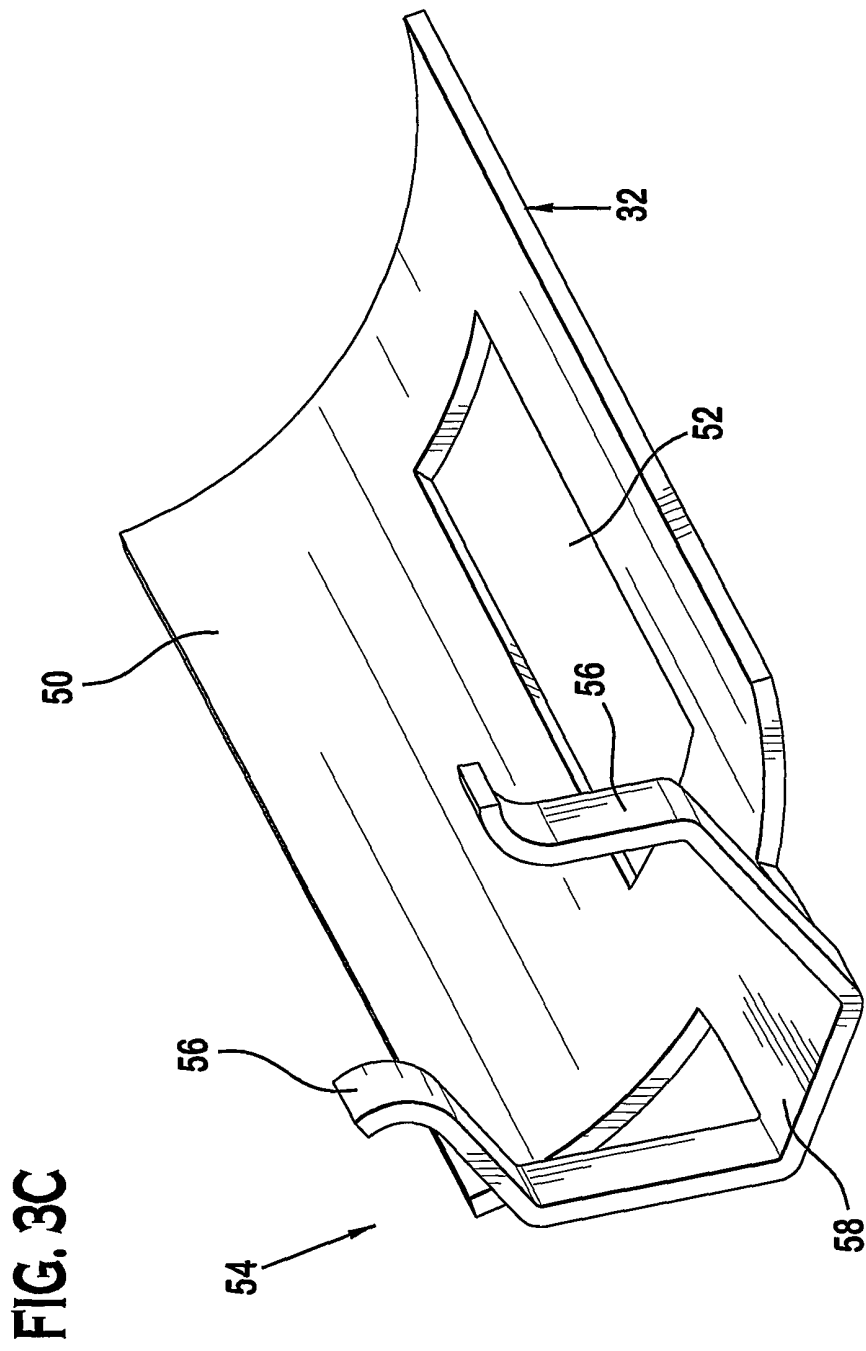
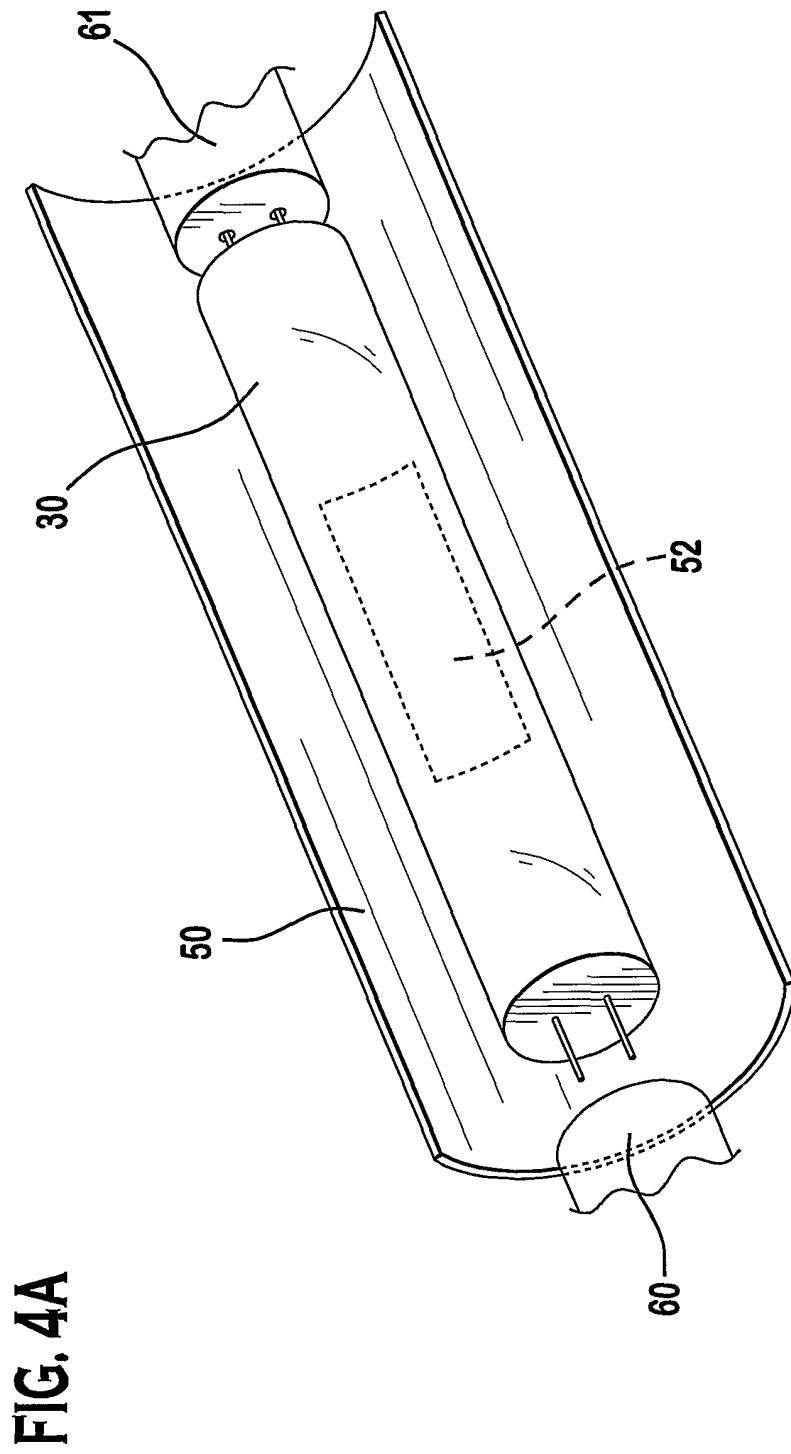


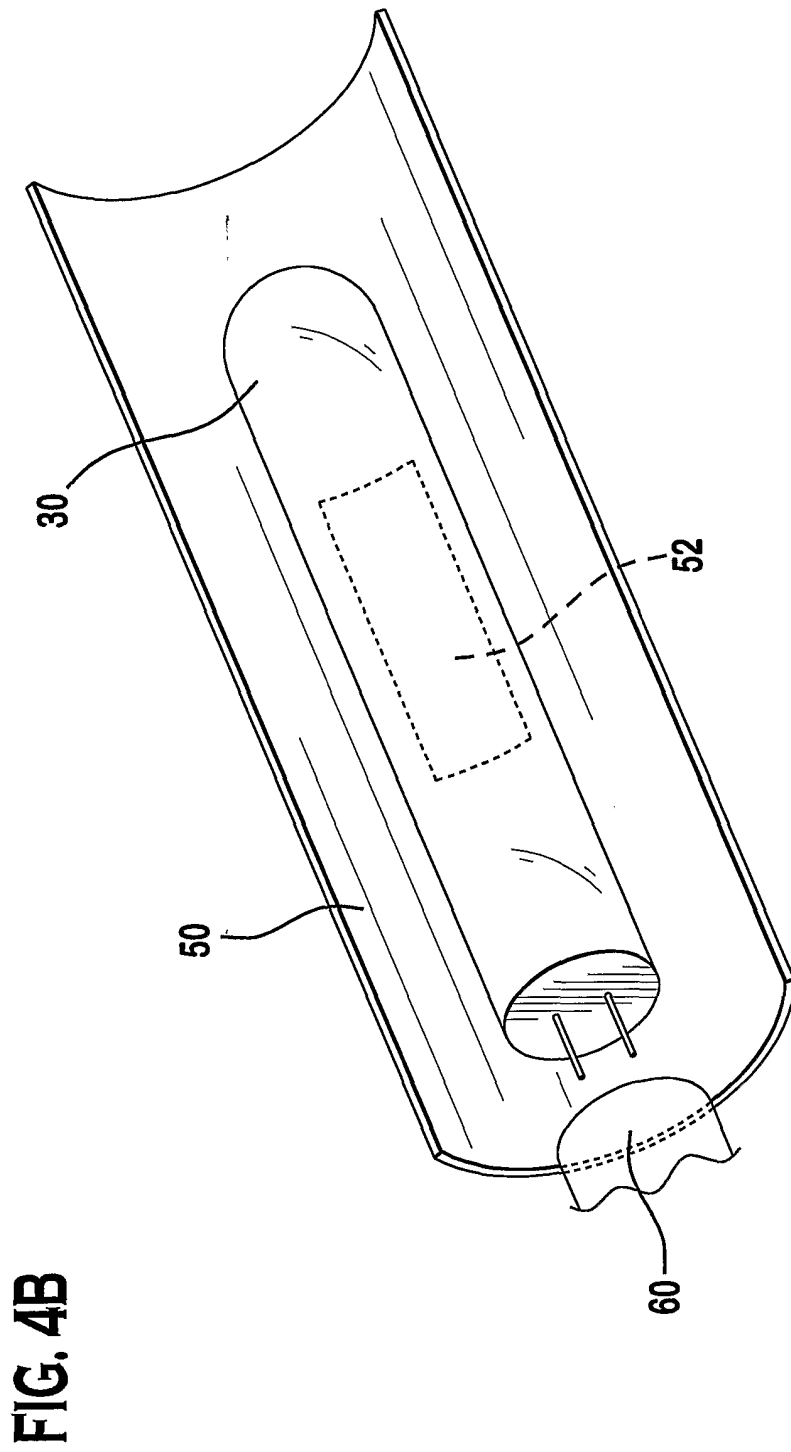
FIG. 3B

5/8





718



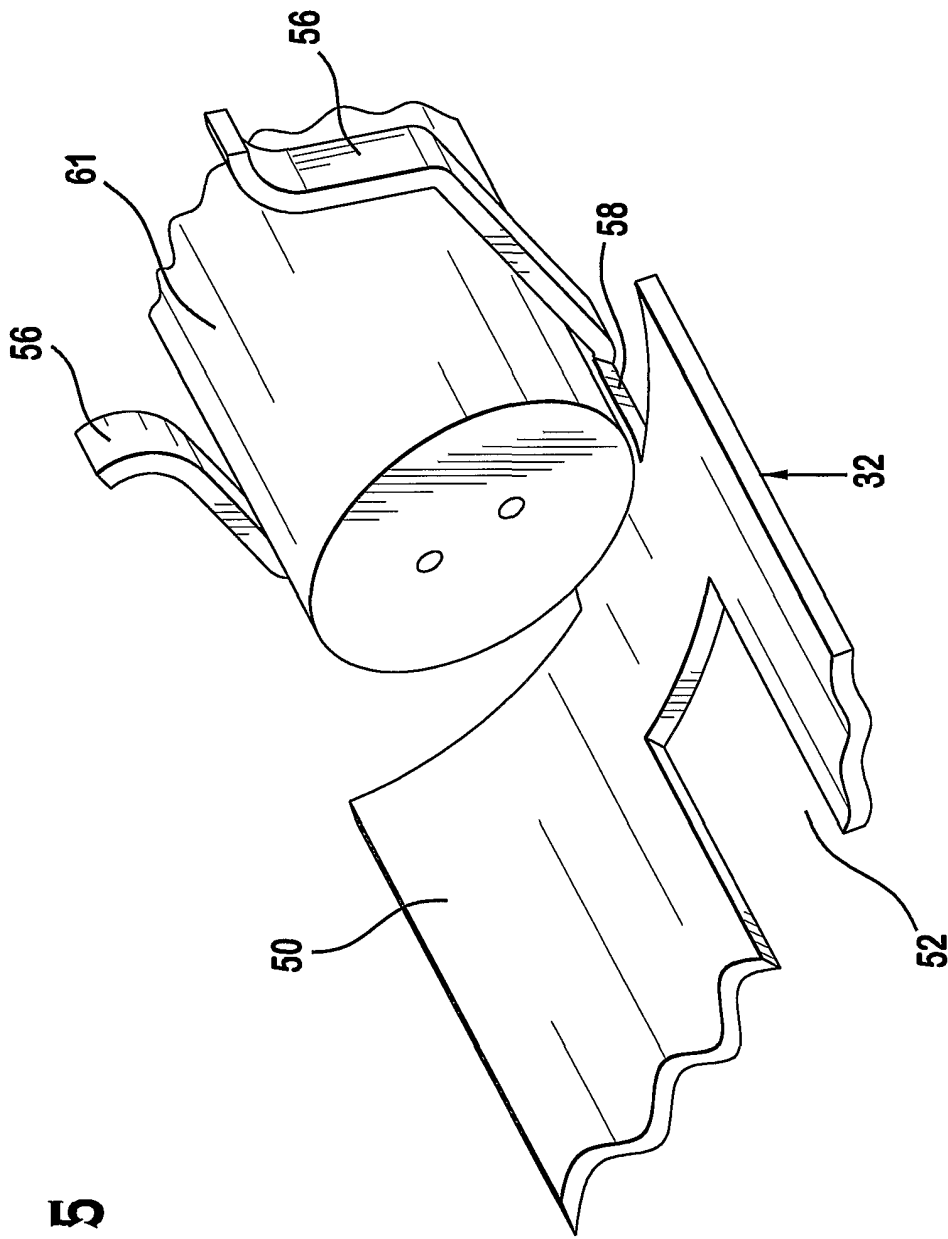


FIG. 5

INTERNATIONAL SEARCH REPORT

Intern Application No  
PCT, JJ 01/07566

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 F21S8/00 F21V17/04 F21V11/08 F21V13/10 F21V25/02

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)  
IPC 7 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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 44 40 135 A (BAMBERGER IND GMBH & CO) 15 May 1996 (1996-05-15) abstract column 1, line 59 -column 2, line 34 column 2, line 65 -column 3, line 1 column 4, line 20-26 column 6, line 15-50 figures 6,8 ---	1-12
X	EP 0 235 652 A (DAUME & JORDAN GMBH & CO KG) 9 September 1987 (1987-09-09) abstract column 2, line 32-49 column 4, line 8-29 column 4, line 44-57 figures 1,3 ---	1,2,5,6
	-/--	

Further documents are listed in the continuation of box C.

Patent family members are listed in 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 document 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.
- \*Z\* document member of the same patent family

Date of the actual completion of the international search

19 June 2001

Date of mailing of the international search report

26/06/2001

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Aubard, S

INTERNATIONAL SEARCH REPORT

Intern: Application No  
PCT/US 01/07566

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 359 069 A (LICENTIA GMBH) 21 March 1990 (1990-03-21) abstract column 3, line 32-39 column 3, line 48 -column 4, line 5 figures 1,3,4,7 ---	1,2,6
X	GB 519 972 A (ARTHUR GAUTIER) 10 April 1940 (1940-04-10) page 1, line 64-96 figure 1 -----	1,2

## INTERNATIONAL SEARCH REPORT

Intern | Application No  
PCT/US 01/07566

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 4440135	A	15-05-1996	NONE	
EP 0235652	A	09-09-1987	DE 3605226 A AT 83546 T DE 3783051 A	27-08-1987 15-01-1993 28-01-1993
EP 0359069	A	21-03-1990	DE 3831205 A	22-03-1990
GB 519972	A	10-04-1940	NONE	