



(12) **United States Patent**
Wegner

(10) **Patent No.:** **US 7,993,034 B2**
(45) **Date of Patent:** **Aug. 9, 2011**

(54) **REFLECTOR HAVING INFLECTION POINT AND LED FIXTURE INCLUDING SUCH REFLECTOR**

(75) Inventor: **Scott David Wegner**, Peachtree City, GA (US)

(73) Assignee: **Cooper Technologies Company**, Houston, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 62 days.

(21) Appl. No.: **12/235,127**

(22) Filed: **Sep. 22, 2008**

(65) **Prior Publication Data**

US 2009/0086481 A1 Apr. 2, 2009

Related U.S. Application Data

(60) Provisional application No. 60/994,792, filed on Sep. 21, 2007, provisional application No. 61/010,549, filed on Jan. 9, 2008, provisional application No. 61/065,914, filed on Feb. 15, 2008, provisional application No. 61/090,391, filed on Aug. 20, 2008.

(51) **Int. Cl.**
F21V 7/09 (2006.01)
F21V 7/20 (2006.01)

(52) **U.S. Cl.** **362/296.05**; 362/304; 362/347; 362/350

(58) **Field of Classification Search** 362/296.01, 362/304, 310, 296.05-296.09, 347, 348, 362/350, 364-366
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,197,187 A * 9/1916 Crownfield 362/304
1,281,752 A * 10/1918 Bailey 362/350
1,447,238 A * 3/1923 Crownfield 362/304

1,711,478 A * 4/1929 Halvorson, Jr. 362/350
1,821,733 A 9/1931 Thibodeau
2,802,933 A 8/1957 Broadwin
3,040,172 A 6/1962 Chan
4,313,154 A 1/1982 Capostagno et al.
4,336,575 A 6/1982 Gilman
4,388,677 A 6/1983 Druffel
4,399,497 A 8/1983 Druffel
4,403,275 A * 9/1983 Oser 362/220
4,475,147 A 10/1984 Kristofek
4,511,113 A 4/1985 Druffel et al.
4,729,080 A 3/1988 Fremont et al.
4,803,603 A 2/1989 Carson
4,829,410 A 5/1989 Patel
4,930,054 A 5/1990 Krebs
4,972,339 A 11/1990 Gabrius
5,057,979 A 10/1991 Carson et al.

(Continued)

OTHER PUBLICATIONS

PCT Search Report for PCT/US2008/077212, mailed Nov. 24, 2008.

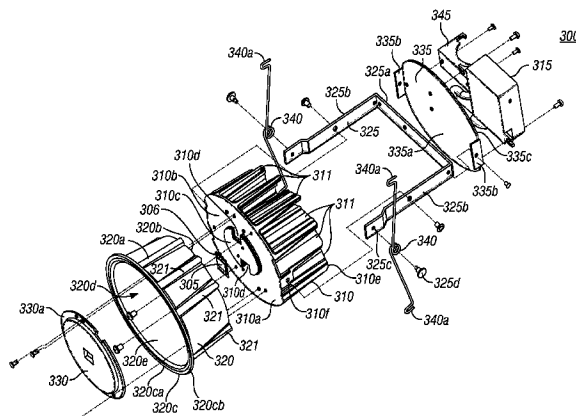
(Continued)

Primary Examiner — Ismael Negron
(74) *Attorney, Agent, or Firm* — King & Spalding, LLP

(57) **ABSTRACT**

A recessed light fixture includes an LED light source and a reflector extending 360 degrees around a center line of light output from the light source. A cross-sectional geometry of the reflector includes a bell-shaped curve with two radii of curvature that join together at an inflection point. One of the radii defines a top portion of the curve, which is disposed above the inflection point and reflects light in a concentrated manner to achieve desired light at higher angles. The other radii defines a bottom portion of the curve, which is disposed below the inflection point and is more diverging than the top portion.

16 Claims, 12 Drawing Sheets
(1 of 12 Drawing Sheet(s) Filed in Color)



U.S. PATENT DOCUMENTS

5,073,845 A 12/1991 Aubrey
 5,075,831 A 12/1991 Stringer et al.
 5,130,913 A 7/1992 David
 5,222,800 A 6/1993 Chan et al.
 5,374,812 A 12/1994 Chan et al.
 5,452,816 A 9/1995 Chan et al.
 5,457,617 A 10/1995 Chan et al.
 5,505,419 A 4/1996 Gabrius
 5,597,234 A 1/1997 Winkelhake
 5,662,414 A 9/1997 Jennings et al.
 5,673,997 A * 10/1997 Akiyama 362/147
 5,690,423 A 11/1997 Hentz et al.
 5,738,436 A 4/1998 Cummings et al.
 5,746,507 A 5/1998 Lee
 5,758,959 A 6/1998 Sieczkowski
 5,826,970 A * 10/1998 Keller et al. 362/147
 5,857,766 A 1/1999 Sieczkowski
 5,957,573 A 9/1999 Wedekind et al.
 5,957,574 A 9/1999 Hentz et al.
 6,030,102 A 2/2000 Gromotka
 6,082,878 A 7/2000 Doubek et al.
 6,152,583 A 11/2000 Langner
 6,203,173 B1 3/2001 Duff et al.
 6,286,265 B1 9/2001 Rinderer
 6,343,871 B1 * 2/2002 Yu 362/249.03
 6,364,511 B1 4/2002 Cohen
 6,431,723 B1 8/2002 Schubert et al.
 6,461,016 B1 10/2002 Jamison et al.
 6,505,960 B2 1/2003 Schubert et al.
 6,554,457 B1 4/2003 Platt
 6,578,983 B2 * 6/2003 Holten 362/225
 6,636,003 B2 10/2003 Rahm et al.
 6,726,347 B2 4/2004 Wronski
 6,853,151 B2 2/2005 Leong et al.
 6,976,769 B2 12/2005 McCullough et al.
 7,018,070 B2 3/2006 McCoy
 7,144,135 B2 12/2006 Martin et al.
 7,213,940 B1 5/2007 Van De Ven et al.
 7,374,308 B2 5/2008 Seveck et al.
 7,524,089 B2 4/2009 Park
 7,568,817 B2 8/2009 Lee et al.
 7,658,517 B2 2/2010 Czech et al.
 7,670,028 B2 3/2010 Liu et al.
 7,722,227 B2 5/2010 Zhang et al.

7,784,969 B2 8/2010 Reisenauer et al.
 2003/0102810 A1 * 6/2003 Cross et al. 315/74
 2004/0012959 A1 * 1/2004 Robertson et al. 362/247
 2005/0174780 A1 8/2005 Park
 2005/0183344 A1 8/2005 Ziobro et al.
 2006/0126325 A1 * 6/2006 Lefebvre et al. 362/217
 2006/0215422 A1 * 9/2006 Laizure et al. 362/650
 2008/0106907 A1 5/2008 Trott et al.
 2008/0165535 A1 7/2008 Mazzochette
 2008/0285271 A1 11/2008 Roberge et al.
 2008/0304269 A1 12/2008 Pickard et al.
 2009/0073688 A1 3/2009 Patrick
 2009/0073689 A1 3/2009 Patrick
 2009/0080189 A1 3/2009 Wegner et al.
 2009/0086476 A1 4/2009 Tickner et al.
 2009/0129086 A1 5/2009 Thompson
 2009/0262530 A1 10/2009 Tickner et al.
 2010/0061108 A1 3/2010 Zhang et al.
 2010/0085766 A1 4/2010 Czech et al.
 2010/0110699 A1 5/2010 Chou

OTHER PUBLICATIONS

U.S. Appl. No. 12/235,116, Tickner et al.
 U.S. Appl. No. 12/235,141, Wegner et al.
 U.S. Appl. No. 12/235,146, Thompson.
 Cree LED Lighting Product Description; 6 Recessed downlight; LR6; Jul. 2009.
 Cree Press Release, "LED Lighting Fixtures Announces Its First LED-Based Recessed Down Light," Feb. 7, 2007.
 Cree Press Release, "Award Winning Custom Home Builder Chooses LED Lighting Fixtures," Mar. 20, 2007.
 Cree Press Release, "LED Lighting Fixtures Announces New Commercial Opportunity for LR6 Downlight," May 3, 2007.
 Cree Press Release, "University of Arkansas to Install LED Lighting Fixture's Downlights," Jun. 25, 2007.
 Cree Press Release, "LED Lighting Fixtures, Inc. achieves unprecedented gain in light output from new luminaire," Apr. 26, 2006.
 Cree Press Release, Cree LR⁶ LED Light Wins Silver International Design Excellence Award (IDEA), Jul. 18, 2008.
 Lighting for Tomorrow 2007 Winners Announced; Sep. 11, 2007.

* cited by examiner

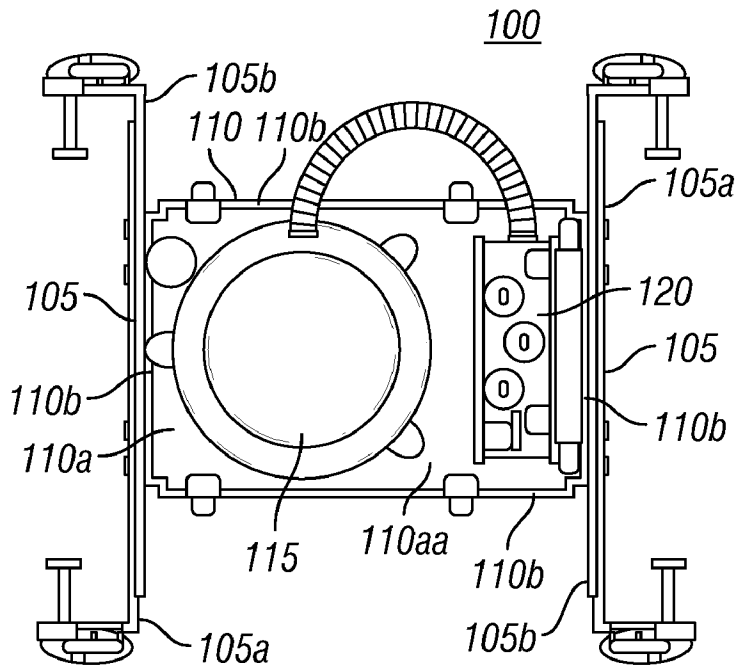


FIG. 1

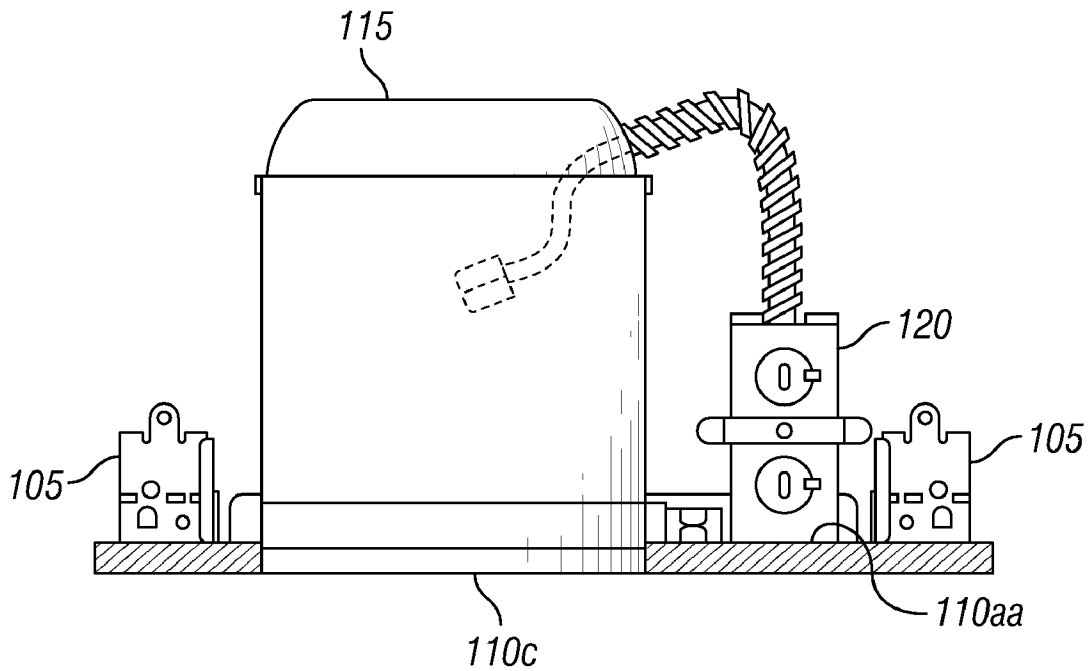


FIG. 2

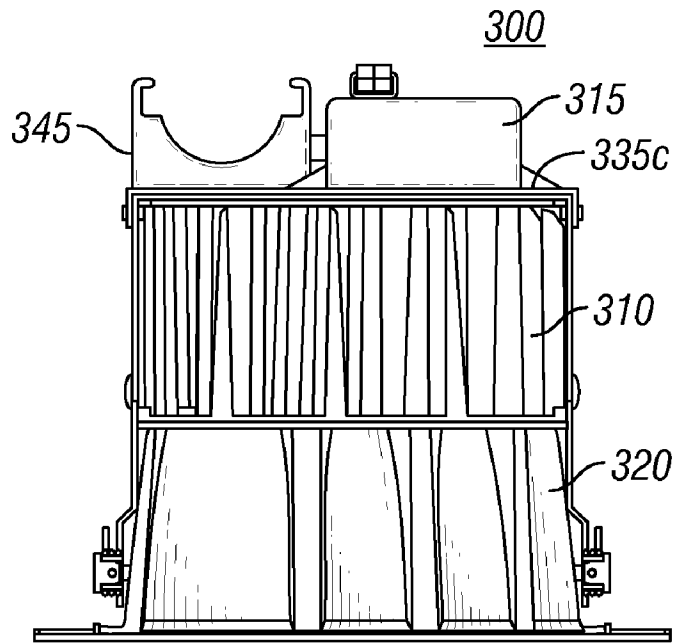


FIG. 3

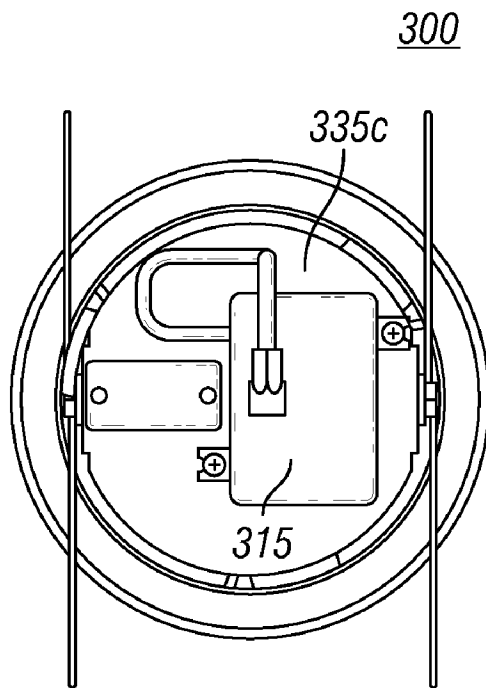


FIG. 4

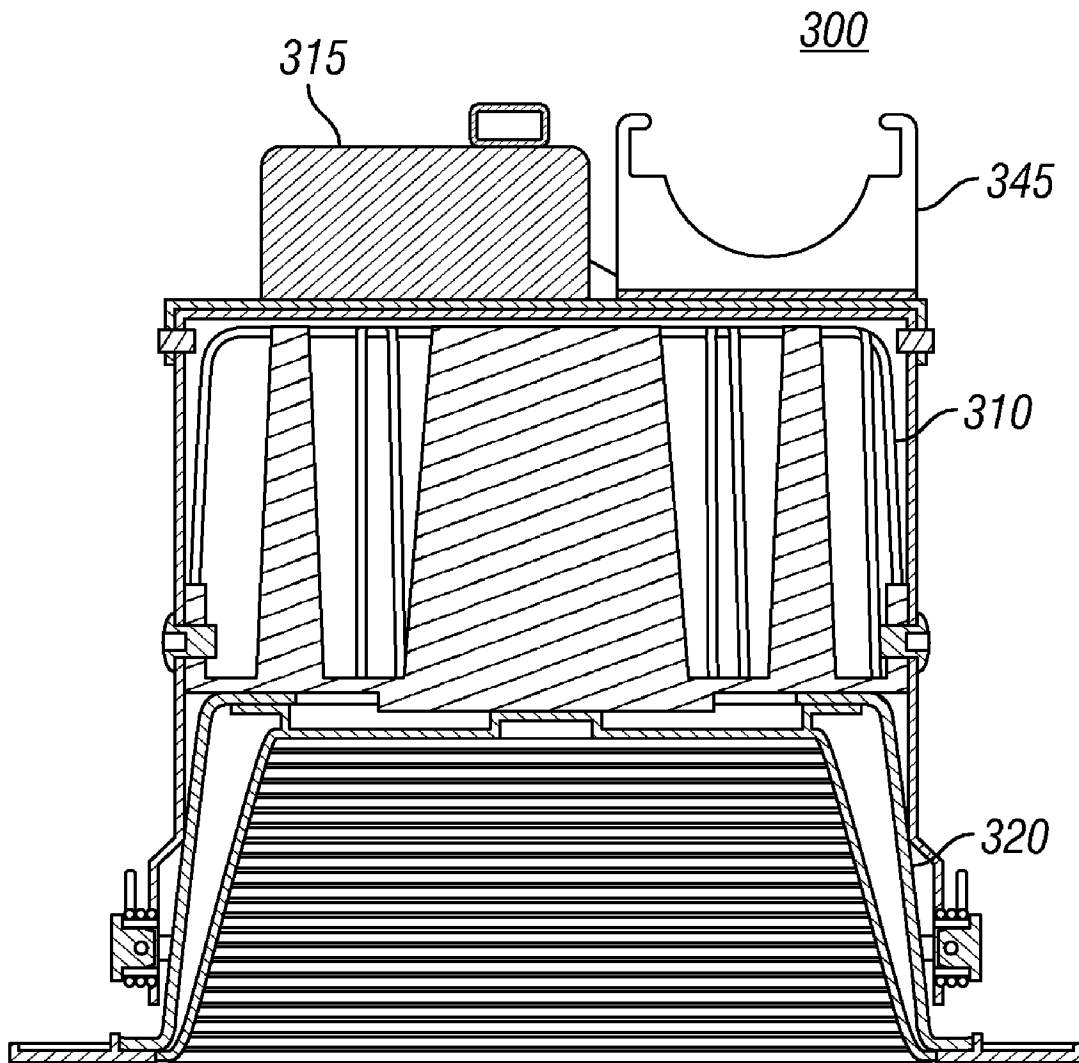


FIG. 5

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.