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(12) **United States Design Patent**  
**Jacobs**

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(54) **THERMOCOUPLE**  
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4,355,912 A 10/1982 Haak  
4,377,347 A 3/1983 Hanmyo et al.  
4,444,990 A 4/1984 Villar  
4,454,370 A 6/1984 Voznick  
4,527,005 A 7/1985 Mckelvey et al.  
4,592,307 A 6/1986 Jolly  
4,692,556 A 9/1987 Bollen et al.  
4,721,533 A 1/1988 Phillippi et al.  
4,721,534 A 1/1988 Phillippi et al.  
4,749,416 A 6/1988 Greenspan  
4,830,515 A 5/1989 Cortes  
4,934,831 A 6/1990 Volbrecht  
4,976,996 A 12/1990 Monkowski et al.

(Continued)

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439/872, 877, 884

FOREIGN PATENT DOCUMENTS

CN 1815155 A 8/2006  
CN 102439402 5/2012

(Continued)

OTHER PUBLICATIONS

Office Action dated Jan. 21, 2013 in Chinese Application No. 201080020268.1.

(Continued)

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

154,695 A 9/1874 Manly  
2,059,480 A 11/1936 Obermaier  
2,266,416 A 12/1941 Duclos  
2,563,931 A 8/1951 Harrison  
2,660,061 A 11/1953 Lewis  
3,011,006 A 11/1961 Nicholson  
3,038,951 A 6/1962 Mead  
D203,117 S \* 12/1965 Hundere ..... D10/60  
3,263,502 A 8/1966 Springfield  
3,588,192 A 6/1971 Drutchas et al.  
3,867,205 A 2/1975 Schley  
3,913,058 A 10/1975 Nishio et al.  
4,093,491 A 6/1978 Whelpton et al.  
4,217,463 A 8/1980 Swearingen  
4,234,449 A 11/1980 Wolson et al.

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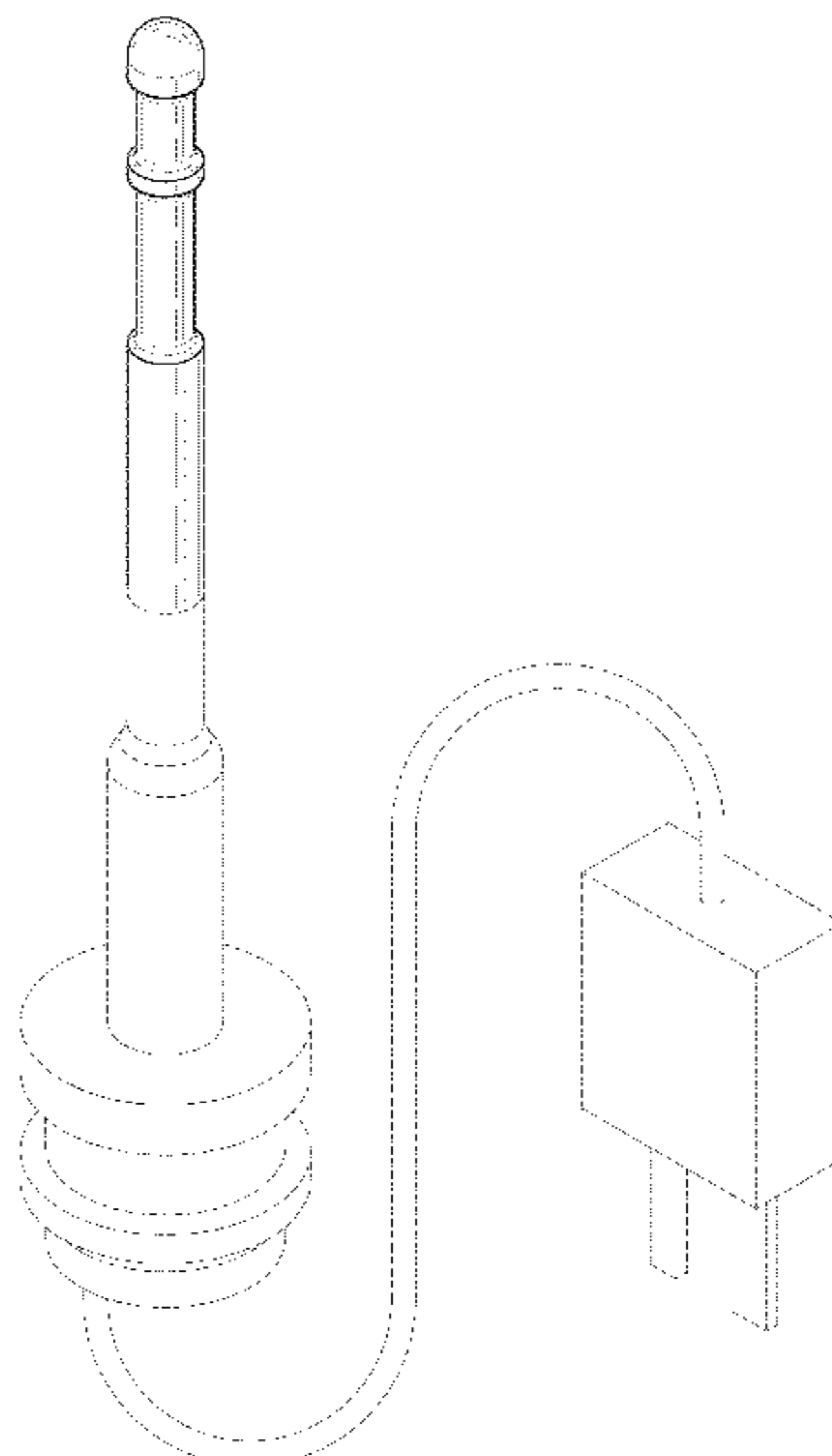
(57) **CLAIM**

The ornamental design for a thermocouple, as shown and described.

**DESCRIPTION**

FIG. 1 is a perspective view of a thermocouple;  
FIG. 2 is a side view thereof; and,  
FIG. 3 is a top view thereof.  
The broken lines shown represent unclaimed subject matter and form no part of the claimed design.

**1 Claim, 2 Drawing Sheets**



(56)

References Cited

U.S. PATENT DOCUMENTS

4,978,567 A 12/1990 Miller  
D313,790 S \* 1/1991 Hirabayashi ..... D13/133  
4,984,904 A 1/1991 Nakano et al.  
4,989,992 A 2/1991 Piai  
5,027,746 A 7/1991 Frijlink  
5,061,083 A 10/1991 Grimm et al.  
5,065,698 A 11/1991 Koike  
5,071,258 A 12/1991 Usher et al.  
5,104,514 A 4/1992 Quartarone  
5,108,192 A 4/1992 Mailliet et al.  
5,137,582 A \* 8/1992 Kasman ..... 136/233  
5,158,128 A 10/1992 Inoue et al.  
5,167,519 A \* 12/1992 Jones et al. .... 439/259  
5,176,451 A 1/1993 Sasada et al.  
5,181,779 A 1/1993 Shia  
D334,147 S \* 3/1993 Aukstikalnis et al. .... D10/80  
5,193,912 A 3/1993 Saunders  
5,246,500 A 9/1993 Samata et al.  
5,271,967 A 12/1993 Kramer et al.  
5,294,778 A 3/1994 Carman et al.  
5,315,092 A 5/1994 Takahashi et al.  
5,336,327 A 8/1994 Lee  
5,360,269 A 11/1994 Ogawa et al.  
5,374,315 A 12/1994 DeBoer et al.  
5,421,893 A 6/1995 Perlov  
5,456,761 A 10/1995 Auger et al.  
5,474,618 A 12/1995 Allaire  
5,493,987 A 2/1996 McDiarmid et al.  
5,514,439 A 5/1996 Sibley  
5,527,111 A 6/1996 Lysen et al.  
5,562,774 A 10/1996 Breidenbach et al.  
5,571,333 A 11/1996 Kanaya  
5,611,265 A 3/1997 Ronci et al.  
5,663,899 A 9/1997 Zvonar et al.  
5,697,706 A 12/1997 Ciaravino et al.  
5,716,133 A 2/1998 Hosokawa et al.  
5,753,835 A 5/1998 Gustin  
D397,043 S \* 8/1998 Kasman ..... D10/52  
5,788,799 A 8/1998 Steger et al.  
5,791,782 A 8/1998 Wooten et al.  
5,806,980 A 9/1998 Berrian  
5,857,777 A 1/1999 Schuh  
D409,746 S \* 5/1999 Hechel ..... D24/112  
5,902,407 A 5/1999 deBoer et al.  
5,904,778 A 5/1999 Lu et al.  
5,910,221 A 6/1999 Wu  
D424,016 S \* 5/2000 Gipson et al. .... D13/133  
6,056,823 A 5/2000 Sajoto et al.  
6,066,209 A 5/2000 Sajoto et al.  
6,102,565 A 8/2000 Kita et al.  
6,104,011 A 8/2000 Juliano  
6,120,640 A 9/2000 Shih et al.  
6,121,061 A 9/2000 Van Bilsen et al.  
6,129,808 A 10/2000 Wicker et al.  
6,170,429 B1 1/2001 Schoepp et al.  
6,193,414 B1 2/2001 Balzano  
6,227,140 B1 5/2001 Kennedy  
6,235,858 B1 5/2001 Swarup et al.  
6,243,654 B1 6/2001 Johnson et al.  
6,257,758 B1 7/2001 Culbertson  
6,293,700 B1 9/2001 Lund et al.  
6,325,858 B1 12/2001 Wengert et al.  
6,342,691 B1 1/2002 Johnsgard et al.  
6,580,050 B1 6/2003 Miller et al.  
6,676,290 B1 1/2004 Lu  
7,008,802 B2 3/2006 Lu  
7,090,394 B2 8/2006 Hashikura et al.  
7,166,165 B2 1/2007 Halpin  
7,168,852 B2 1/2007 Linnarsson  
7,223,014 B2 5/2007 Lojen  
7,274,867 B2 9/2007 Peukert  
D596,137 S \* 7/2009 Sakamoto ..... D13/154  
7,561,982 B2 7/2009 Rund et al.  
D604,252 S \* 11/2009 Yudate ..... D13/154  
7,651,269 B2 1/2010 Comendant

7,753,584 B2 7/2010 Gambino et al.  
7,789,559 B2 9/2010 Waser et al.  
7,871,198 B2 1/2011 Rempe et al.  
7,874,726 B2 1/2011 Jacobs et al.  
7,946,762 B2 5/2011 Yednak, III  
D639,740 S \* 6/2011 Chi ..... D13/133  
7,957,708 B2 6/2011 Karschnia et al.  
8,046,193 B2 10/2011 Yetter et al.  
8,078,310 B2 12/2011 Nishimoto et al.  
8,100,583 B2 1/2012 Conner et al.  
8,262,287 B2 9/2012 Darabnia et al.  
8,382,370 B2 2/2013 Aggarwal et al.  
D685,327 S \* 7/2013 Rayner ..... D13/133  
2002/0009119 A1 1/2002 Matthew et al.  
2002/0011211 A1 1/2002 Halpin  
2002/0043337 A1 4/2002 Goodman et al.  
2003/0002562 A1 1/2003 Yerlikaya et al.  
2003/0035905 A1 2/2003 Lieberman et al.  
2003/0192435 A1 10/2003 McNair  
2005/0092733 A1 5/2005 Ito et al.  
2005/0101843 A1 5/2005 Quinn et al.  
2005/0141591 A1 6/2005 Sakano  
2006/0026314 A1 2/2006 Franchuk et al.  
2006/0275933 A1 12/2006 Du Bois et al.  
2007/0062439 A1 3/2007 Wada et al.  
2007/0119377 A1 5/2007 Halpin  
2007/0258506 A1 11/2007 Schwagerman et al.  
2008/0043803 A1 2/2008 Bando  
2008/0205483 A1 8/2008 Rempe et al.  
2008/0228306 A1 9/2008 Yetter et al.  
2008/0289574 A1 11/2008 Jacobs et al.  
2009/0034582 A1 2/2009 Carcasi  
2009/0052498 A1 2/2009 Halpin et al.  
2009/0159000 A1 6/2009 Aggarwal et al.  
2009/0204403 A1 8/2009 Hollander et al.  
2009/0308425 A1 12/2009 Yednak, III  
2010/0145547 A1 6/2010 Darabnia et al.  
2010/0246630 A1 9/2010 Kaszynski et al.  
2010/0282163 A1 11/2010 Aggarwal et al.  
2010/0284438 A1 11/2010 Aggarwal et al.  
2010/0286842 A1 11/2010 Aggarwal et al.  
2012/0310440 A1 12/2012 Darabnia et al.

FOREIGN PATENT DOCUMENTS

CN 102439712 5/2012  
EP 0229488 7/1987  
EP 0723141 7/1996  
EP 0887632 12/1998  
EP 2156155 2/2010  
EP 2185745 5/2010  
EP 2304402 4/2011  
EP 2370996 10/2011  
FR 1408266 8/1965  
GB 0752277 7/1956  
JP 5819462 4/1982  
JP 7-209093 8/1985  
JP 02185038 7/1990  
JP 05-023079 3/1993  
JP 5-64627 3/1993  
JP 05118928 5/1993  
JP 09-089676 4/1997  
JP 10-153494 6/1998  
JP 10-227703 8/1998  
JP 11-118615 4/1999  
JP 11-183264 7/1999  
JP 11-183265 7/1999  
JP 11-287715 10/1999  
JP 2004-113270 4/2004  
JP 2005-172489 6/2005  
JP 2006-090762 4/2006  
JP 2006-153706 6/2006  
JP 2001522141 11/2010  
JP 2010537202 12/2010  
JP 2012526282 10/2012  
KR 10-2000-0031098 6/2000  
KR 10-2002-0086763 11/2002  
KR 10-2003-0092305 12/2003  
WO 9531582 11/1995

(56)

**References Cited**

## FOREIGN PATENT DOCUMENTS

WO	9706288	2/1997
WO	99/23690	5/1999
WO	9923276	5/1999
WO	0111223	2/2001
WO	2008147731	12/2008
WO	2009029532	3/2009
WO	2009154896	12/2009
WO	2010077533	7/2010
WO	2010129428	11/2010
WO	2010129430	11/2010
WO	2010129431	11/2010

## OTHER PUBLICATIONS

Final Office Action dated Apr. 17, 2013 in U.S. Appl. No. 12/193,924.  
 Summary of Office Action received Apr. 25, 2013 in Japanese Application No. 2012-509857.  
 Office Action dated May 28, 2013 in U.S. Appl. No. 13/563,274.  
 Office Action dated May 31, 2013 in U.S. Appl. No. 12/436,306.  
 Advisory Action dated Jul. 9, 2013 in U.S. Appl. No. 12/193,924.  
 Office Action dated Sep. 3, 2013 in Taiwanese Application No. 97132391.  
 Introduction to Materials Science for Engineers, 3rd Ed., James F. Shackelford, pp. 398, Macmillan Publishing Co. (1992).  
 Linke, J. and Vietzke, E., "Behavior of Boron Doped Graphites, Plasma Sprayed Boron Carbides and a-C/B H as Plasma Facing Material," J. Fusion Tech., V.20, pp. 228-231 (Sep. 1991).  
 Ponnekanti et al., "Failure Mechanisms of Anodized Aluminum Parts Used in Chemical Vapor Deposition Chambers," J. Vac. Sci. Technol. A 14(3) (May 1, 1996).  
 "Thermocouples for Silicon Process Technologies," Vulcan Electric Company brochure.  
 "Thermocouples for the Semiconductor Industry," Engelhard Corporation brochure (2004).  
 PCT Notification of Transmittal of the International Search Report and The Written Opinion of the International Searching Authority, or the Declaration, for International App. No. PCT/US2008/063919 dated Aug. 21, 2008.  
 PCT Notification of Transmittal of the International Search Report and The Written Opinion of the International Searching Authority, or the Declaration, for International App. No. PCT/US2008/074063 dated Mar. 5, 2009.  
 PCT Notification of Transmittal of the International Search Report and Written Opinion for International Application No. PCT/US2009/043454 dated Nov. 27, 2009.  
 International Preliminary Report on Patentability for International App. No. PCT/US2008/074063 dated Feb. 24, 2010.  
 Non-Final Office Action for U.S. Appl. No. 12/121,085 dated Apr. 28, 2010.  
 International Search Report and Written Opinion for International Application No. PCT/US2010/033244 dated Jun. 29, 2010.  
 International Search Report and Written Opinion for International Application No. PCT/US2009/066377 dated Jul. 1, 2010.  
 Chinese Office Action dated Jul. 14, 2010 in Application No. 200880012927.  
 International Search Report and Written Opinion for International Application No. PCT/US2010/033248 dated Jul. 29, 2010.  
 Notice of Allowance for U.S. Appl. No. 12/121,085 dated Jul. 26, 2010.  
 Non-Final Office Action for U.S. Appl. No. 12/140,809 dated Sep. 13, 2010.  
 Notice of Allowance dated Oct. 4, 2010 in U.S. Appl. No. 12/121,085.

Final Office Action for U.S. Appl. No. 12/140,809 dated Dec. 28, 2010.  
 International Search Report and Written Opinion for International Application No. PCT/US2010/033252 dated Jan. 28, 2011.  
 Non-Final Office Action dated Mar. 15, 2011 for U.S. Appl. No. 12/193,924.  
 Notice of Allowance dated Mar. 17, 2011 for U.S. Appl. No. 12/140,809.  
 Examination Report Dated May 26, 2011 for App. No. 09733043.5-2313.  
 International Preliminary Report on Patentability dated Jun. 23, 2011 in Application No. PCT/US2009/066377.  
 Non-Final Office Action dated Jul. 28, 2011 for U.S. Appl. No. 12/330,096.  
 Non-Final Office Action dated Aug. 3, 2011 for U.S. Appl. No. 12/436,300.  
 Non-Final Office Action dated Aug. 3, 2011 for U.S. Appl. No. 12/436,315.  
 Final Office Action dated Sep. 30, 2011 for U.S. Appl. No. 12/193,924.  
 International Preliminary Report on Patentability for International Application No. PCT/US2010/033244 dated Nov. 9, 2011.  
 Notice of Allowance for U.S. Appl. No. 12/436,315 dated Nov. 17, 2011.  
 International Preliminary Report on Patentability for PCT/US2010/033244 dated Nov. 17, 2011.  
 International Preliminary Report on Patentability for PCT/US2010/033248 dated Nov. 17, 2011.  
 International Preliminary Report on Patentability for PCT/US2010/033252 dated Nov. 17, 2011.  
 Restriction Requirement for U.S. Appl. No. 12/436,306 dated Dec. 20, 2011.  
 Official Action for Japanese Patent Application 2010-522075 dated Dec. 20, 2011.  
 Final Office Action dated Jan. 13, 2012 for U.S. Appl. No. 12/330,096.  
 Final Office Action dated Jan. 23, 2012 for U.S. Appl. No. 12/436,300.  
 Notice of Allowance dated Mar. 6, 2012 for U.S. Appl. No. 12/330,096.  
 Advisory Action dated Mar. 6, 2012 for U.S. Appl. No. 12/436,300.  
 Non-Final Office Action dated Mar. 20, 2012 for U.S. Appl. No. 12/330,096.  
 Non-Final Office Action dated Apr. 11, 2012 for U.S. Appl. No. 12/436,306.  
 Official Action for Japanese Patent Application 2010-522075 mailed on Apr. 13, 2012.  
 Non-Final Office Action dated May 22, 2012 in U.S. Appl. No. 12/436,300.  
 Office Action dated Jun. 4, 2012 in Japanese Application No. 2011-514650.  
 Notice of Allowance dated Jun. 7, 2012 in U.S. Appl. No. 12/330,096.  
 Office Action dated Sep. 13, 2012 in Japanese Application No. 2011-514650.  
 Final Office Action dated Sep. 26, 2012 in U.S. Appl. No. 12/436,306.  
 Office Action dated Oct. 24, 2012 in U.S. Appl. No. 12/193,924.  
 Extended Search Report dated Nov. 9, 2012 in European Application No. 08798519.8.  
 Notice of Allowance dated Nov. 28, 2012 in U.S. Appl. No. 12/436,300.  
 Notice of Allowance dated Dec. 21, 2012 in Japanese Application No. 2011-514650.

\* cited by examiner

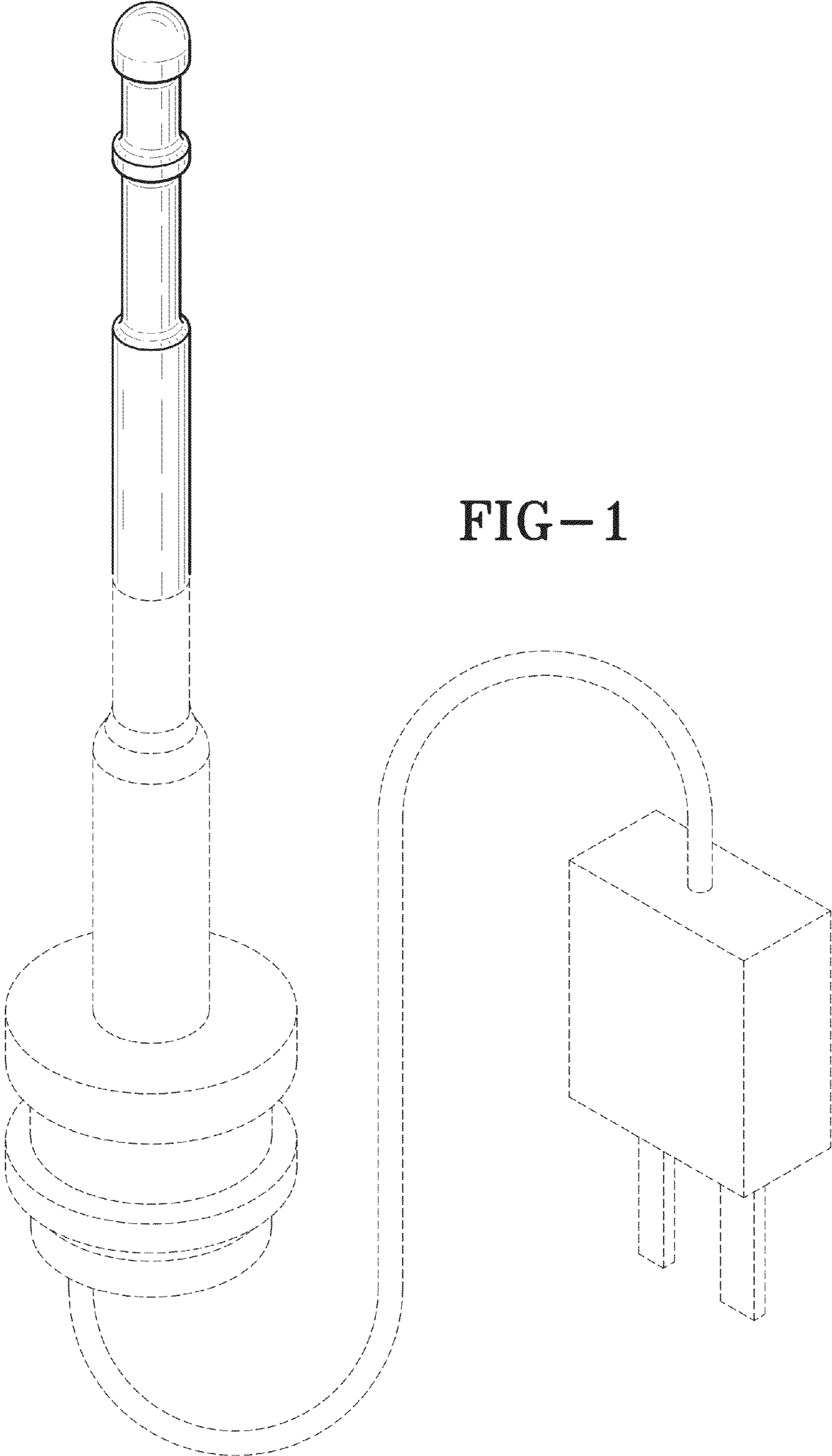


FIG-1

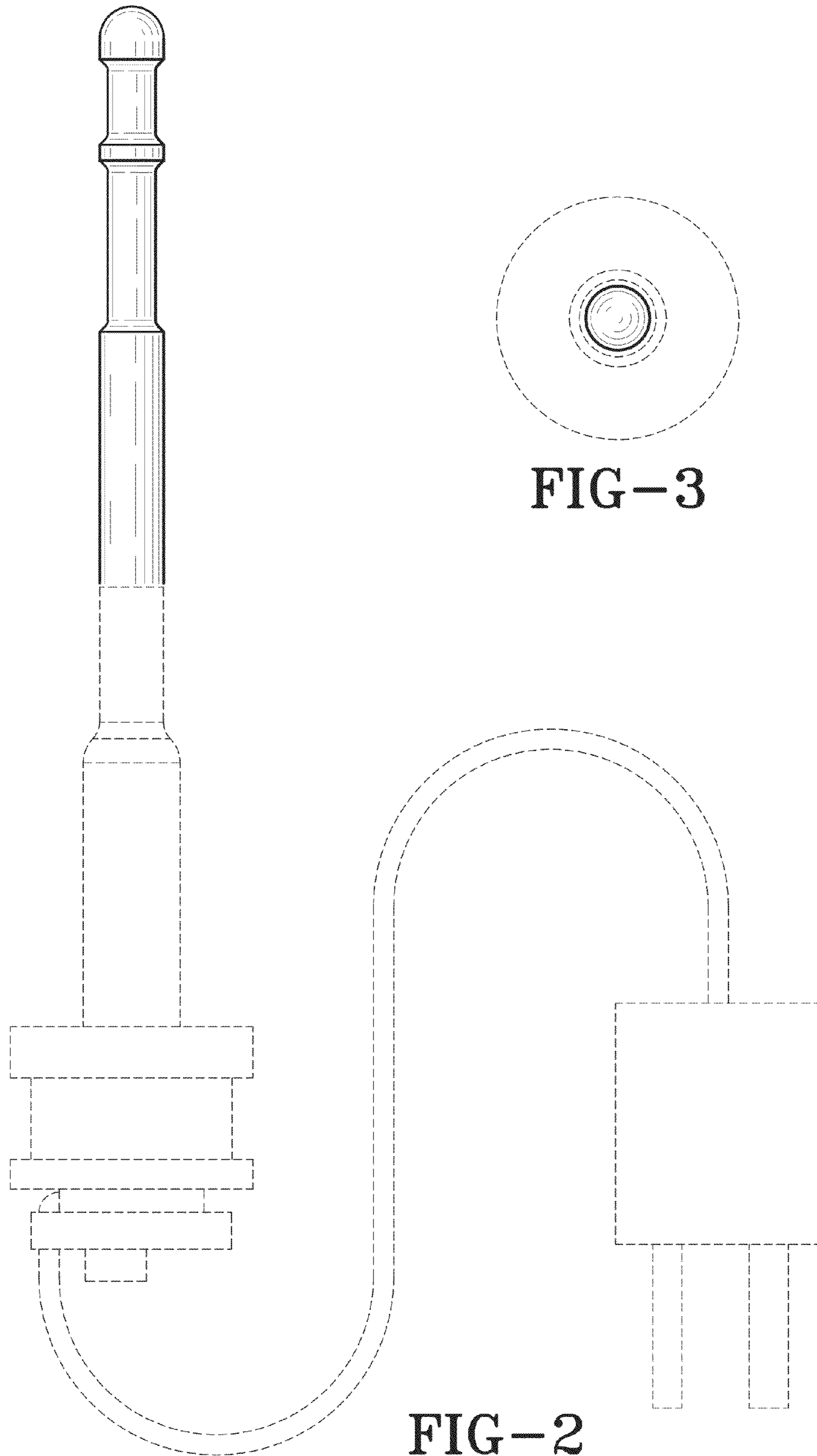


FIG-3

FIG-2