

(12) **United States Patent**
Burnett

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(54) **METHODS AND DEVICES FOR
PERFORMING ELECTRICAL STIMULATION
TO TREAT VARIOUS CONDITIONS**

(71) Applicant: **EMKinetics, Inc.**, San Francisco, CA
(US)

(72) Inventor: **Daniel R. Burnett**, San Francisco, CA
(US)

(73) Assignee: **EMKinetics, Inc.**, San Francisco, CA
(US)

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(56) **References Cited**

U.S. PATENT DOCUMENTS

2,003,392 A 6/1935 Rucker
2,893,392 A 7/1959 Wagner et al.
(Continued)

FOREIGN PATENT DOCUMENTS

EP 2493551 9/2012
GB 2298370 9/1996
(Continued)

OTHER PUBLICATIONS

Amarengo et al., "Urodynamic effect of acute transcutaneous pos-
terior tibial nerve stimulation in overactive bladder," Jun. 2003,
Journal of Urology, vol. 169, 2210-2215. (Year: 2003).*

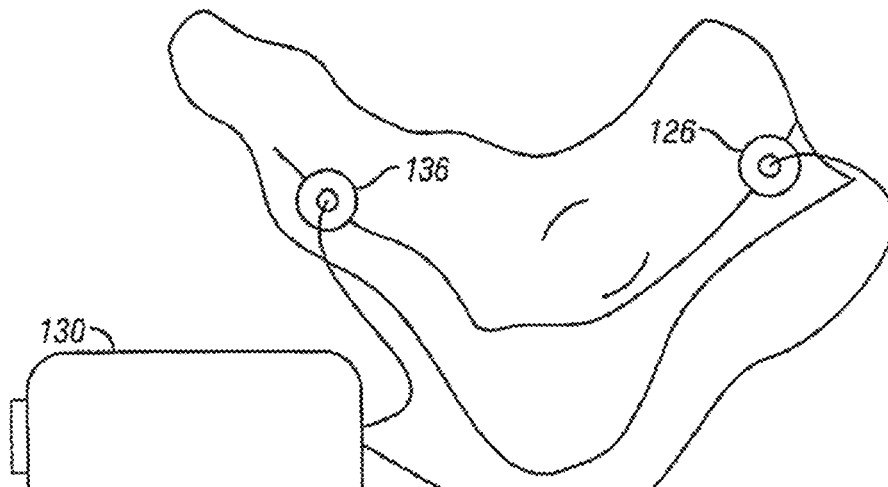
(Continued)

Primary Examiner — Michael W Kahelin
(74) *Attorney, Agent, or Firm* — Levine Bagade Han LLP

(57) **ABSTRACT**

In certain variations, systems and/or methods for electro-
magnetic induction therapy are provided. One or more
ergonomic or body contoured applicators may be included.
The applicators include one or more conductive coils con-
figured to generate an electromagnetic or magnetic field
focused on a target nerve, muscle or other body tissues
positioned in proximity to the coil. One or more sensors may
be utilized to detect stimulation and to provide feedback
about the efficacy of the applied electromagnetic induction
therapy. A controller may be adjustable to vary a current
through a coil to adjust the magnetic field focused upon the
target nerve, muscle or other body tissues based on the
feedback provide by a sensor or by a patient. In certain
systems or methods, pulsed magnetic fields may be inter-
mittently applied to a target nerve, muscle or tissue without
causing habituation.

13 Claims, 37 Drawing Sheets



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continuation of application No. 14/676,635, filed on Apr. 1, 2015, now Pat. No. 9,387,338, which is a continuation of application No. 14/085,639, filed on Nov. 20, 2013, now Pat. No. 9,002,477, which is a continuation of application No. 13/456,016, filed on Apr. 25, 2012, now abandoned, which is a continuation of application No. PCT/US2010/054167, filed on Oct. 26, 2010, said application No. 14/085,639 is a continuation-in-part of application No. 12/508,529, filed on Jul. 23, 2009, now abandoned, which is a continuation-in-part of application No. 11/866,329, filed on Oct. 2, 2007, now abandoned.

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(56) **References Cited**

U.S. PATENT DOCUMENTS

3,034,507 A 5/1962 McConnell et al.
3,817,254 A 6/1974 Maurer
3,841,305 A 10/1974 Hallgren
4,233,965 A 11/1980 Fairbanks
4,266,533 A 5/1981 Ryaby et al.
4,428,366 A 1/1984 Findl et al.
4,456,012 A 6/1984 Lattin
4,548,208 A 10/1985 Niemi
4,574,809 A 3/1986 Talish et al.
4,784,737 A 11/1988 Ray et al.
4,804,054 A 2/1989 Howson et al.
4,837,049 A 6/1989 Byers et al.
4,915,110 A 4/1990 Kitov
4,926,878 A 5/1990 Snedeker
4,940,453 A 7/1990 Cadwell
4,969,468 A 11/1990 Byers et al.
4,994,015 A 2/1991 Cadwell
5,000,178 A 3/1991 Griffith
5,014,699 A 5/1991 Pollack et al.
5,067,478 A 11/1991 Berlant
5,092,835 A 3/1992 Schurig et al.
5,158,080 A 10/1992 Kallok
5,181,902 A 1/1993 Erickson et al.
5,299,572 A 4/1994 Chen et al.
5,309,909 A 5/1994 Gadsby et al.
5,314,401 A 5/1994 Tepper
5,314,453 A 5/1994 Jeutter
5,374,283 A 12/1994 Flick
5,401,233 A 3/1995 Erickson et al.
5,449,378 A 9/1995 Schouenborg
5,518,495 A 5/1996 Kolt
5,540,735 A 7/1996 Wingrove

5,715,837 A 2/1998 Chen
5,725,471 A 3/1998 Davey et al.
5,749,909 A 5/1998 Schroepel et al.
5,766,124 A 6/1998 Polson
5,792,187 A 8/1998 Adams
5,792,209 A 8/1998 Varner
5,833,600 A 11/1998 Young
5,857,957 A 1/1999 Lin
5,978,712 A 11/1999 Suda et al.
5,984,854 A 11/1999 Ishikawa et al.
5,995,873 A 11/1999 Rhodes
6,009,878 A 1/2000 Weijand et al.
6,024,691 A 2/2000 Tepper et al.
6,029,090 A 2/2000 Herbst
6,032,677 A 3/2000 Blechman et al.
6,066,084 A 5/2000 Edrich et al.
6,086,525 A 7/2000 Davey et al.
6,088,619 A 7/2000 Hein et al.
6,123,658 A 9/2000 Schweighofer et al.
6,132,386 A 10/2000 Gozani et al.
6,143,035 A 11/2000 McDowell
6,155,966 A 12/2000 Parker
6,179,770 B1 1/2001 Mould
6,190,893 B1 2/2001 Shastri et al.
6,200,259 B1 3/2001 March
6,213,933 B1 4/2001 Lin
6,219,575 B1 4/2001 Nemati
6,256,533 B1 7/2001 Yuzhakov et al.
6,261,221 B1 7/2001 Tepper et al.
6,312,612 B1 11/2001 Sherman et al.
6,319,241 B1 11/2001 King et al.
6,334,856 B1 1/2002 Allen et al.
6,349,233 B1 2/2002 Adams
6,366,795 B1 4/2002 Bremer et al.
6,379,313 B1 4/2002 Gozani et al.
6,379,324 B1 4/2002 Gartstein et al.
6,432,037 B1* 8/2002 Eini A61B 5/04882
128/898
6,440,096 B1 8/2002 Lastovich et al.
6,443,883 B1 9/2002 Ostrow et al.
6,451,240 B1 9/2002 Sherman et al.
6,471,903 B2 10/2002 Sherman et al.
6,473,652 B1 10/2002 Sarval et al.
6,491,620 B1 12/2002 Davey
6,493,588 B1 12/2002 Malaney et al.
6,500,110 B1 12/2002 Davey et al.
6,503,231 B1 1/2003 Prausnitz et al.
6,511,463 B1 1/2003 Wood et al.
6,527,694 B1 3/2003 Ishikawa et al.
6,533,949 B1 3/2003 Yeshurun et al.
6,537,242 B1 3/2003 Palmer
6,553,263 B1 4/2003 Meadows et al.
6,558,361 B1 5/2003 Yeshurun
6,565,532 B1 5/2003 Yuzhakov et al.
6,582,393 B2 6/2003 Sage, Jr.
6,591,124 B2 7/2003 Sherman et al.
6,595,947 B1 7/2003 Mikszta et al.
6,603,987 B2 8/2003 Whitson
6,611,707 B1 8/2003 Prausnitz et al.
6,615,080 B1 9/2003 Unsworth et al.
6,622,035 B1 9/2003 Merilainen et al.
6,623,457 B1 9/2003 Rosenberg
6,652,443 B1 11/2003 Struppler et al.
6,652,478 B1 11/2003 Gartstein et al.
6,654,636 B1 11/2003 Dev et al.
6,656,147 B1 12/2003 Gertsek et al.
6,663,556 B2 12/2003 Barker
6,663,820 B2 12/2003 Arias et al.
6,671,527 B2 12/2003 Petersson et al.
6,678,556 B1 1/2004 Nolan et al.
6,684,106 B2 1/2004 Herbst
6,689,100 B2 2/2004 Connelly et al.
6,690,959 B2 2/2004 Thompson
6,692,444 B2 2/2004 Gozani et al.
6,697,669 B2 2/2004 Dev et al.
6,701,185 B2 3/2004 Burnett et al.
6,735,474 B1 5/2004 Loeb et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

6,770,022 B2	8/2004	Mechlenburg et al.	7,941,201 B2	5/2011	Chiou et al.
6,770,480 B1	8/2004	Canham	8,308,665 B2	11/2012	Harry et al.
6,782,283 B2	8/2004	Schmidt et al.	8,430,805 B2	4/2013	Burnett et al.
6,790,372 B2	9/2004	Roy et al.	8,435,166 B2	5/2013	Burnett et al.
6,808,506 B2	10/2004	Lastovich et al.	8,588,884 B2	11/2013	Hegde et al.
6,835,184 B1	12/2004	Sage et al.	8,660,646 B2	2/2014	Laing et al.
6,866,659 B2	3/2005	Nemati	8,805,510 B2	8/2014	Chancellor et al.
6,881,203 B2	4/2005	Delmore et al.	8,812,114 B2	8/2014	Van den biggelaar et al.
6,899,838 B2	5/2005	Lastovich	8,818,520 B2	8/2014	Laing et al.
6,904,614 B2	6/2005	Yamazaki et al.	8,954,153 B2	2/2015	Boggs
6,908,453 B2	6/2005	Fleming et al.	9,002,477 B2	4/2015	Burnett
6,926,660 B2	8/2005	Miller	9,005,102 B2	4/2015	Burnett et al.
6,931,277 B1	8/2005	Yuzhakov et al.	9,056,194 B2	6/2015	Van den biggelaar et al.
6,939,311 B2	9/2005	Geiger	9,076,187 B1	7/2015	Laing et al.
6,941,171 B2	9/2005	Mann et al.	9,245,265 B2	1/2016	Laing et al.
6,960,193 B2	11/2005	Rosenberg	9,265,941 B2	2/2016	Van den biggelaar et al.
6,962,772 B2	11/2005	Liu et al.	9,339,641 B2	5/2016	Rajguru et al.
6,972,013 B1	12/2005	Zhang et al.	9,387,338 B2	7/2016	Burnett
6,980,855 B2	12/2005	Cho	9,610,459 B2	4/2017	Burnett et al.
7,013,179 B2	3/2006	Carter et al.	9,630,004 B2	4/2017	Rajguru et al.
7,027,478 B2	4/2006	Ackley	9,757,584 B2	9/2017	Burnett
7,032,302 B1	4/2006	Schmidt et al.	10,786,669 B2	9/2020	Rajguru et al.
7,045,069 B2	5/2006	Ozeryansky	2002/0007128 A1	1/2002	Ives et al.
7,047,070 B2	5/2006	Wilkinson et al.	2002/0028991 A1	3/2002	Thompson
7,048,723 B1	5/2006	Frazier et al.	2002/0040233 A1	4/2002	George et al.
7,079,355 B2	7/2006	Hsiao et al.	2002/0055761 A1	5/2002	Mann et al.
7,083,592 B2	8/2006	Lastovich et al.	2002/0082465 A1	6/2002	Bashford et al.
7,104,947 B2	9/2006	Riehl	2002/0099323 A1	7/2002	Dev et al.
7,115,108 B2	10/2006	Wilkinson et al.	2002/0111777 A1	8/2002	David
7,117,034 B2	10/2006	Kronberg	2002/0133129 A1	9/2002	Arias et al.
7,130,696 B2	10/2006	Carter et al.	2002/0138116 A1	9/2002	Bertolucci
7,132,054 B1	11/2006	Kravitz et al.	2002/0183804 A1	12/2002	Malaney et al.
7,153,256 B2	12/2006	Riehl et al.	2662/6183647	12/2002	Gozani et al.
7,187,976 B2	3/2007	Duncan et al.	2003/0003968 A1	1/2003	Muraki
7,226,439 B2	6/2007	Prausnitz et al.	2003/0004392 A1	1/2003	Tanner et al.
7,262,068 B2	8/2007	Roy et al.	2003/0028072 A1	2/2003	Fischell et al.
7,273,474 B2	9/2007	Chang et al.	2003/0144625 A1	7/2003	Sherman et al.
7,285,113 B2	10/2007	Yeshurun	2003/0158583 A1	8/2003	Burnett et al.
7,315,758 B2	1/2008	Kwiatkowski et al.	2003/0158585 A1	8/2003	Burnett
7,316,665 B2	1/2008	Laurent et al.	2003/0216729 A1	11/2003	Marchitto et al.
7,320,664 B2	1/2008	Riehl et al.	2003/0217754 A1	11/2003	Thomas et al.
7,332,197 B2	2/2008	Wood et al.	2004/0010276 A1	1/2004	Jacobs et al.
7,332,339 B2	2/2008	Canham	2004/0015188 A1	1/2004	Coulter
7,344,499 B1	3/2008	Prausnitz et al.	2004/0054393 A1	3/2004	Stemme et al.
7,367,936 B2	5/2008	Myers et al.	2004/0082875 A1	4/2004	Donoghue et al.
D571,920 S	6/2008	Juliana et al.	2004/0092860 A1	5/2004	Dev et al.
7,396,326 B2	7/2008	Ghiron et al.	2004/0102819 A1	5/2004	Zou et al.
7,410,476 B2	8/2008	Wilkinson et al.	2004/0111139 A1	6/2004	McCreery
7,415,299 B2	8/2008	Zimmermann et al.	2004/0122787 A1	6/2004	Avanash et al.
7,416,541 B2	8/2008	Yuzhakov et al.	2004/0127939 A1	7/2004	Grey
7,429,333 B2	9/2008	Chiou et al.	2004/0138517 A1	7/2004	Osorio et al.
7,473,244 B2	1/2009	Frazier et al.	2004/0146611 A1	7/2004	Arias et al.
7,481,337 B2	1/2009	Luharuka et al.	2004/0147964 A1	7/2004	Nolan et al.
7,497,980 B2	3/2009	Xu et al.	2004/0173220 A1	9/2004	Harry et al.
7,500,911 B2	3/2009	Johnson et al.	2004/0210254 A1	10/2004	Burnett et al.
7,520,848 B2	4/2009	Schneider et al.	2004/0210282 A1	10/2004	Flock et al.
7,522,061 B2	4/2009	Rondoni et al.	2004/0237170 A1	12/2004	Yamazaki et al.
7,530,968 B2	5/2009	Gonnelli	2005/0021104 A1	1/2005	Dilorenzo
7,536,226 B2	5/2009	Williams et al.	2005/0029223 A1	2/2005	Yeshurun
7,556,615 B2	7/2009	Pettis et al.	2005/0033380 A1	2/2005	Tanner et al.
7,556,821 B2	7/2009	Ameri et al.	2005/0099290 A1	5/2005	Govari
7,560,036 B2	7/2009	Golubovic-Liakopoulos et al.	2005/0107654 A1	5/2005	Riehl
7,570,992 B2	8/2009	Nolan et al.	2005/0143783 A1	6/2005	Boveja et al.
7,572,405 B2	8/2009	Sherman et al.	2005/0143789 A1	6/2005	Whitehurst et al.
7,574,256 B2	8/2009	Carter	2005/0171576 A1	8/2005	Williams et al.
7,578,954 B2	8/2009	Gartstein et al.	2005/0203602 A1	9/2005	Wallace et al.
7,582,069 B2	9/2009	Laurent et al.	2005/0240230 A1	10/2005	Preston et al.
7,588,552 B2	9/2009	Yeshurun et al.	2005/0277998 A1	12/2005	Tracey et al.
7,591,806 B2	9/2009	Xu	2005/0283202 A1	12/2005	Gellman
7,627,938 B2	12/2009	Kim et al.	2005/0283204 A1	12/2005	Buhlmann et al.
7,628,761 B2	12/2009	Gozani et al.	2006/0004244 A1	1/2006	Phillips et al.
7,647,112 B2	1/2010	Tracey et al.	2006/0015153 A1	1/2006	Gliner et al.
7,648,484 B2	1/2010	Yeshurun et al.	2006/0016452 A1	1/2006	Goetz et al.
			2006/0030845 A1	2/2006	Leung et al.
			2006/0047316 A1	3/2006	Fischell et al.
			2006/0047326 A1	3/2006	Wheeler
			2006/0049957 A1	3/2006	Surgenor et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2006/0084938	A1	4/2006	Zhang et al.	
2006/0115130	A1	6/2006	Kozlay	
2006/0122454	A1	6/2006	Riehl et al.	
2006/0122660	A1	6/2006	Boveja et al.	
2006/0135844	A1	6/2006	Alekseyenko	
2006/0155345	A1	7/2006	Williams et al.	
2006/0161039	A1	7/2006	Juliana et al.	
2006/0173261	A1	8/2006	Kall et al.	
2006/0178576	A1	8/2006	Weber et al.	
2006/0184211	A1	8/2006	Gaunt et al.	
2006/0199159	A1	9/2006	Ghiron et al.	
2006/0276702	A1	12/2006	McGinnis	
2007/0021712	A1	1/2007	Bernard et al.	
2007/0021803	A1	1/2007	Deem et al.	
2007/0027353	A1	2/2007	Ghiron et al.	
2007/0027354	A1	2/2007	Riehl et al.	
2007/0027355	A1	2/2007	Riehl et al.	
2007/0142885	A1	6/2007	Hantash et al.	
2007/0208212	A1	9/2007	Dilorenzo	
2007/0250162	A1	10/2007	Royalty	
2007/0265489	A1	11/2007	Fowler et al.	
2007/0265675	A1*	11/2007	Lund	A61N 1/36007 607/41
2007/0276318	A1	11/2007	Henley	
2007/0282246	A1	12/2007	Henley	
2008/0004484	A1	1/2008	Wieraszko et al.	
2008/0033510	A1	2/2008	Herregraven et al.	
2008/0058874	A1	3/2008	Westlund et al.	
2008/0063866	A1	3/2008	Allen et al.	
2008/0065167	A1	3/2008	Boggs et al.	
2008/0097142	A1	4/2008	Savage	
2008/0114199	A1	5/2008	Riehl et al.	
2008/0177128	A1	7/2008	Riehl et al.	
2008/0177347	A1	7/2008	Tehrani et al.	
2008/0183070	A1	7/2008	Unal et al.	
2008/0200748	A1	8/2008	Testanl et al.	
2008/0224808	A1	9/2008	Ghiron et al.	
2008/0262287	A1	10/2008	Dussau	
2008/0288035	A1	11/2008	Gill et al.	
2008/0300655	A1	12/2008	Cholette	
2008/0306325	A1	12/2008	Burnett et al.	
2008/0312725	A1	12/2008	Penner	
2009/0030337	A1	1/2009	Gozani et al.	
2009/0054950	A1	2/2009	Stephens	
2009/0073991	A1	3/2009	Landrum et al.	
2009/0076336	A1	3/2009	Mazar et al.	
2009/0076340	A1	3/2009	Libbus et al.	
2009/0076344	A1	3/2009	Libbus et al.	
2009/0076345	A1	3/2009	Manicka et al.	
2009/0076363	A1	3/2009	Bly et al.	
2009/0076364	A1	3/2009	Libbus et al.	
2009/0076397	A1	3/2009	Libbus et al.	
2009/0076410	A1	3/2009	Libbus et al.	
2009/0076559	A1	3/2009	Libbus et al.	
2009/0076565	A1	3/2009	Surwit	
2009/0099623	A1	4/2009	Bentwich	
2009/0118777	A1	5/2009	Iki et al.	
2009/0132018	A1	5/2009	DiUbaldo et al.	
2009/0162570	A1	6/2009	Swenberg et al.	
2009/0171236	A1	7/2009	Davies	
2009/0198305	A1	8/2009	Naroditsky et al.	
2009/0227829	A1	9/2009	Burnett et al.	
2009/0227831	A1	9/2009	Burnett et al.	
2009/0234179	A1	9/2009	Burnett et al.	
2009/0234410	A1	9/2009	Libbus et al.	
2009/0264792	A1	10/2009	Mazar	
2009/0292194	A1	11/2009	Libbus et al.	
2010/0016929	A1	1/2010	Prochazka	
2010/0022864	A1	1/2010	Cordero et al.	
2010/0049021	A1	2/2010	Jina et al.	
2010/0056881	A1	3/2010	Libbus et al.	
2010/0057147	A1	3/2010	Fassih et al.	
2010/0057149	A1	3/2010	Fahey	

2010/0160712	A1	6/2010	Burnett et al.
2010/0161005	A1	6/2010	Wahlgren et al.
2010/0168501	A1	7/2010	Burnett et al.
2010/0204538	A1	8/2010	Burnett et al.
2010/0222629	A1	9/2010	Burnett et al.
2010/0222630	A1	9/2010	Mangrum et al.
2010/0318009	A1	12/2010	Stanley
2011/0021863	A1	1/2011	Burnett et al.
2011/0144468	A1	6/2011	Boggs et al.
2011/0264163	A1	10/2011	Tracey et al.
2011/0270140	A1	11/2011	Israeli
2011/0295100	A1	12/2011	Hegde et al.
2012/0059432	A1	3/2012	Emborg et al.
2012/0101326	A1	4/2012	Simon et al.
2012/0302821	A1	11/2012	Burnett
2013/0006322	A1	1/2013	Tai
2013/0072746	A1	3/2013	Burnett et al.
2013/0072835	A1	3/2013	Harry et al.
2013/0310909	A1	11/2013	Simon et al.
2014/0046423	A1	2/2014	Rajguru et al.
2014/0148870	A1	5/2014	Burnett
2014/0213842	A1	7/2014	Simon et al.
2014/0249595	A1	9/2014	Chancellor et al.
2014/0288613	A1	9/2014	Laing et al.
2015/0190648	A1	7/2015	Fischell et al.
2015/0202454	A1	7/2015	Burnett
2015/0227909	A1	8/2015	Laing et al.
2015/0260471	A1	9/2015	Azhocar
2016/0067515	A1	3/2016	Burnett et al.
2016/0067517	A1	3/2016	Burnett
2016/0074671	A1	3/2016	Burnett et al.
2016/0193466	A1	7/2016	Burnett
2018/0050216	A9	2/2018	Burnett
2018/0133472	A1	5/2018	Tai
2020/0139120	A1	5/2020	Rajguru et al.

FOREIGN PATENT DOCUMENTS

GB	2336544	10/1999
JP	2000-254239	9/2000
WO	WO 2003/070317	8/2003
WO	WO 2006/061688	6/2006
WO	WO 2008/032279	3/2008
WO	WO 2008/042902	4/2008
WO	WO 2008/115426	9/2008
WO	WO 2010/047599	4/2010
WO	WO 2010/084482	7/2010
WO	WO 2011/011748	1/2011
WO	WO 2011/011749	1/2011
WO	WO 2011/053607	5/2011
WO	WO 2011/053661	5/2011
WO	WO 2011/150332	12/2011
WO	WO 2012/040243	3/2012

OTHER PUBLICATIONS

"Tibial Nerve." Wikipedia, accessed Oct. 5, 2020, https://en.wikipedia.org/wiki/Tibial_nerve. (Year: 2020).*

"Bioflex® RX754P, Single Coated Medical Pressure Sensitive Adhesive Tape," *Technical Data*, 2 pages, Dec. 2005.

3M Corporation, 3M™ XYZ/Isotropic Electrically Conductive Adhesive Transfer Tape 9707, *3M Electronics Markets Materials Division*, 60-5002-0350-4, 8 pages, 2004, 3M.

Aaron, Roy K. et al., "Therapeutic Effects of Electromagnetic Fields in the Stimulation of Connective Tissue Repair," *Journal of Cellular Biophysics*, 52(1):42-6, May 1993, Wiley-Liss, Inc.

AmGel Technologies, "AG603 Sensing Gel, Sensing Gel Designed for ECG Applications," AG603-3/10, 1 page, 2010.

AmGel Technologies, "AG702 Stimulating Gel, Stimulating Gel Designed for carbon film," AG702-02/06, 1 page, 2006.

AmGel Technologies, "AG902-184/229 Grounding Gel, Grounding Gel Designed for Electrosurgical Pads," AG902 Series, 1 page, 2010.

(56)

References Cited

OTHER PUBLICATIONS

- Balmaseda, Marion T. Jr., et al., "Burns in Functional Electric Stimulation: Two Case Reports," *Archives of Physical Medicine and Rehabilitation*, vol. 38., pp. 452-453, Jul. 1987.
- Biowave Corporation, "510(k) Summary for the Biowave Deepwave Neuromodulation Pain Therapy Device," 6 pages, Appendix B, Dec. 13, 2005.
- Biowave Corporation, "510(k) Summary for the Biowave Deepwave Neuromodulation Pain Therapy Device," 7 pages, Appendix E, Aug. 15, 2006.
- Biowave Corporation, "Percutaneous Neuromodulation Pain Therapy System," *deepwave*, RevB/080926, 2008.
- BlueCross BlueShield of Kansas City, "Percutaneous Electrical Nerve Stimulation (PENS) and Percutaneous Neuromodulation Therapy (PNT)," 7 pages, 1988.
- Bodhale, D.W. et al., "Design, fabrication and analysis of silicon microneedles for transdermal drug delivery applications," *Proceedings of the 3rd International Conference on the Development of BME in Vietnam*, pp. 84-88, Jan. 11-14, 2010.
- Bruce, C.J. et al., "Intracardiac Echocardiography," *European Journal Echocardiography*, vol. 2, pp. 234-244, 2001, The European Society of Cardiology.
- Cabodevila, G. et al., "An overview on drug delivery using microneedles," *Institute FEMTO-ST, Dept LPMO*, 24 pages, Oct. 2005, Workshop Micro Dosing Systems.
- Certified Pulsed Signal Therapy Centers, <http://www.certifiedpst.com>, 10 pages.
- Choi, S. et al., "Microneedle Electrode Array for Electroporation of Skin for Gene Therapy," 2 pages, 2005, Controlled Release Society 32nd Annual Meeting and Exposition Transactions.
- Curley, S. et al., "Radiofrequency Ablation of Unresectable Primary and Metastatic Hepatic Malignancies," *Annals of Surgery*, vol. 230(1):1-8, 1999 Lippincott Williams & Wilkins, Inc.
- CystoMedix, Inc., "Percutaneous Tibial Nerve Stimulation via Urgent® PC Neuromodulation System—An Emerging Technology for managing Overactive Bladder," *Business Briefing: Global Surgery*, 6 pages, 2004.
- EBI, L.P., EBI Bone Healing System, <http://www.ebimedical.com/products/fracture/bonehealing.html>, 5 pages.
- Fallon Community Health Plan, "Spinal Cord Stimulation," 4 pages, 2006.
- Grundfest H. et al., "Stainless Steel Micro-Needle Electrodes Made by Electrolytic Pointing," *Review of Scientific Instruments*, vol. 21(4):2 pages, 1950, American Institute of Physics.
- Harvinder S. Gil et al., "Effect of microneedle design on pain in human subjects," *NIH Public Access Author Manuscript*, 24(7): 585-594, Sep. 2008, Clinical Journal of Pain.
- Huber, D.E. et al., "Popliteal Vein Compression Under General Anaesthesia," *European Journal of Vascular and Endovascular Surgery*, vol. 37, pp. 464-469, 2009, Elsevier Ltd.
- Isseroff, Roslyn R. et al., "Beta Adrenergic Receptor (β AR) Signaling as a novel target for optimizing skin wound healing," 5 pages.
- Jacobson, Jerry I. et al., "Low-Amplitude, Extremely Low Frequency Magnetic Fields for the Treatment of Osteoarthritic Knees: A Double-Blind Clinical Study," *Electromagnetic Fields and Human Health. Fundamental and Applied Research*, pp. 363-364, Sep. 17-24, 2002, Proceedings of the Third International Conference.
- Jasper, H. et al., "Unipolar Electromyograms of Normal and Denervated Human Muscle," pp. 231-244, Oct. 12, 1948, Department of Neurology and Neurosurgery, McGill University, and Montreal Neurological Institute.
- Kravitz, S. et al., "Microneedles for In-Situ/In-vivo Electrochemical Sensor Applications," 1 page, Sandia National Laboratories.
- Kurtzke, John F., "Epidemiology of Spinal Cord injury," *IV Panamerican Congress of Neurology*, 18(2-3): 157-90, 93, 1975.
- Luttge, R., "Microneedle array electrode for human EEG recording," IFMBE Proceedings 22, pp. 1246-1249, 2008, Springer-Verag Berlin Heidelberg 2009.
- Maass et al., "Contactless Nerve Stimulation and Signal Detection by Inductive Transducer," *Symposium on Application of Magnetism in Bioengineering*, 1969.
- McFarlane, J.P. et al., "Acute Suppression of Idiopathic Detrusor Instability with Magnetic Stimulation of the Sacral Nerve Roots," *British Journal of Urology*, 80(5): 734-41, Nov. 1997.
- Morrison, P.R. et al., "Radiofrequency Ablation of Thoracic Lesions: Part I, Experiments in the Normal Porcine Thorax," *American Journal of Roentgenology*, 2005;184:375-380, Feb. 2005, American Roentgen Ray Society.
- NeuroStar TMS Therapy, NeuroStar TMS Therapy® Recipient of Medical Design Excellence Award, *PRNewswire*, 3 pages, Apr. 2009.
- Newmark, Inc., "Standard Products, Highest Quality Components, Designed & Produced Exclusively for Electrode Manufacturers," *Innovation by Design Newmark*, 2 pages, www.newmarkinc.com/std_prods.htm, printed on May 3, 2010.
- Noble, J.H. et al., "Automatic segmentation of the facial nerve and chorda tympani in CT images using spatially dependent features values," *Medical Physics*, vol. 35(12), pp. 5375-5384, Dec. 2008, American Association Physical Medicine.
- Patel, G. et al., "Microneedles: The option for painless delivery," www.pharmainfo.net/reviews/microneedles-option-painless-delivery, 6 pages, printed on Sep. 9, 2008.
- Pubmed, U.S. National Library of Medicine National Institutes of Health, microneedle array electrode—Pub Med results, www.ncbi.nlm.nih.gov/sites/entrez, 2 pages, Search performed on Apr. 22, 2010.
- Pubmed, U.S. National Library of Medicine National Institutes of Health, microneedle electrode—Pub Med results, www.ncbi.nlm.nih.gov/sites/entrez, 7 pages, Search performed on Apr. 22, 2010.
- Schaefer, O. et al., "CT-guided radiofrequency ablation of a bronchogenic carcinoma," *The British Journal of Radiology*, 76 (2003), pp. 268-270, 2003, The British Institute of Radiology.
- Shafik, Ahmed, "Magnetic Stimulation: A Novel Method for Inducing Evacuation of the Neuropathic Rectum and Urinary Bladder in a Canine Model," *Urology* 54(2):368-372, Aug. 1999.
- Sheridan, M.T. et al., "Pretreatment apoptosis in carcinoma of the cervix correlates with changes in tumour oxygenation during radiotherapy," *British Journal of Cancer*, 82(6):1177-1182, 2000 Cancer Research Campaign.
- Sivagangabalan, G. et al., "Comparison of Electroanatomic Contact and Noncontact Mapping of Ventricular Scar in a Postinfarct Ovine Model With Intramural Needle Electrode Recording and Histological Validation," *Circulation: Arrhythmia and Electrophysiology, Journal of the American Heart Association*, vol. 1:363-369, 2008, American Heart Association.
- Solbiati, L. et al., "Percutaneous US-guided Radio-Frequency Tissue Ablation of Liver Metastases: Treatment and Follow-up in 16 Patients," *Radiology*, 202(1):195-203, 1997 L.S. RSNA.
- The Magstim Company Ltd, "Air Film Coil," *Magstim*, 4 pages, 2007.
- Thon, W.F. et al., "Neuromodulation of voiding dysfunction and pelvic pain," *World Journal of Urology*, vol. 9: pp. 138-141, 1991, Springer-Verlag.
- Trock, David H., "Electromagnetic Fields and Magnets Investigational Treatment for Musculoskeletal Disorders," *Rheumatic Diseases Clinics of North America*, vol. 26, No. 1, Feb. 2000.
- Trock, David H., et al., "The Effect of Pulsed Electromagnetic Fields in the Treatment of Osteoarthritis of the Knee and Cervical Spine. Report of Randomized, Double Blind, Placebo Controlled Trials," *The Journal of Rheumatology*, 1903-1911, 1994.
- Tyco Adhesives, "2932 Designed Adhesives," *Specialty Tape Group*, 1 page.
- vanSonnenberg, E. et al., "Radiofrequency Ablation of Thoracic Lesions: Part 2, Initial Clinical Experience—Technical and Multidisciplinary Considerations in 30 Patients," *American Journal of*

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