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(56) **References Cited**

U.S. PATENT DOCUMENTS

4,151,637	A	5/1979	Zemek et al.
4,241,497	A	12/1980	Du Bois
4,245,385	A	1/1981	Zemek et al.
4,447,945	A	5/1984	Priscsak
4,724,613	A	2/1988	Dale
4,839,612	A	6/1989	Akagi
4,857,483	A	8/1989	Steffen et al.
5,049,979	A	9/1991	Hashemi et al.
5,151,770	A	9/1992	Inoue
5,166,772	A	11/1992	Soldner et al.
5,166,864	A	11/1992	Chitwood et al.
5,266,819	A	11/1993	Chang et al.
5,300,895	A	4/1994	Jones
5,347,229	A	9/1994	Suckling et al.
5,355,016	A	10/1994	Swirbel et al.
5,378,922	A	1/1995	Sovero
5,428,508	A	6/1995	Pronto
5,445,976	A	8/1995	Henderson et al.
5,878,335	A	3/1999	Kushner
5,940,964	A	8/1999	Mugiya
6,075,995	A	6/2000	Jensen
6,137,693	A	10/2000	Schwiebert et al.
6,192,577	B1	2/2001	Larsson
6,201,454	B1	3/2001	Kinayman et al.
6,202,294	B1	3/2001	Bogannam
6,233,440	B1	5/2001	Taylor
6,236,071	B1	5/2001	Finlay
6,275,687	B1	8/2001	Lloyd
6,350,951	B1	2/2002	Askew
6,384,688	B1	5/2002	Fujioka et al.
6,426,881	B1	7/2002	Kurz
6,449,828	B2	9/2002	Pahl et al.
6,459,104	B1	10/2002	Schuegraf
6,462,436	B1	10/2002	Kay et al.
6,472,724	B1	10/2002	Matsuzawa et al.
6,486,549	B1	11/2002	Chiang
6,559,517	B2	5/2003	Zhu
6,563,145	B1	5/2003	Chang et al.
6,566,596	B1	5/2003	Askew
6,573,599	B1	6/2003	Burton et al.
6,577,199	B2	6/2003	Dent
6,586,782	B1	7/2003	Finlay
6,601,293	B1	8/2003	Glenn
6,627,925	B1	9/2003	Finlay
6,650,009	B2	11/2003	Her
6,656,809	B2	12/2003	Greenberg et al.
6,678,513	B2	1/2004	Glasbrener et al.
6,724,263	B2 *	4/2004	Sugiura 330/302
6,759,597	B1	7/2004	Cutting et al.
6,777,268	B2	8/2004	Jiang
6,787,427	B2	9/2004	Greenberg et al.
6,797,995	B2	9/2004	Pierson, Jr. et al.
6,798,050	B1	9/2004	Homma et al.
6,800,531	B2	10/2004	Pierson, Jr. et al.
6,850,746	B1	2/2005	Lloyd et al.
6,855,893	B2	2/2005	Kumakura et al.
6,855,992	B2	2/2005	Emrick et al.
6,858,522	B1	2/2005	Burton et al.
6,858,887	B1	2/2005	Li et al.
6,865,084	B2	3/2005	Lin et al.
6,906,359	B2	6/2005	Zampardi et al.
6,930,334	B2	8/2005	Suzuki et al.
6,947,295	B2	9/2005	Hsieh
6,949,776	B2	9/2005	Pierson, Jr. et al.
6,956,283	B1	10/2005	Peterson
6,958,491	B1	10/2005	Brar et al.
6,974,724	B2	12/2005	Hyvonen et al.
6,994,901	B1	2/2006	Chen et al.
7,030,469	B2	4/2006	Mahadevan et al.
7,038,250	B2	5/2006	Sugiyama et al.
7,061,119	B1	6/2006	Jiang
7,088,009	B2	8/2006	Hagen
7,116,175	B2 *	10/2006	Shimizu et al. 330/307
7,198,987	B1	4/2007	Warren et al.
7,372,334	B2	5/2008	Blair et al.
7,563,713	B2	7/2009	Rowell et al.
7,687,886	B2	3/2010	Pan et al.
7,723,824	B2	5/2010	Guarin et al.
7,728,357	B2	6/2010	Murayama et al.
7,755,107	B2	7/2010	Zampardi et al.
7,791,132	B2	9/2010	Banerjee et al.
7,880,275	B2	2/2011	Pagaila et al.
7,898,066	B1	3/2011	Scanlan et al.
7,958,629	B2	6/2011	Thompson et al.
8,026,555	B2	9/2011	Zampardi et al.
8,071,431	B2	12/2011	Hoang et al.
8,129,824	B1	3/2012	Amand et al.
8,134,228	B2	3/2012	Komatsu et al.
8,159,048	B2	4/2012	Apel et al.
8,164,387	B1	4/2012	Apel et al.
8,188,575	B2	5/2012	Riege et al.
8,227,892	B2	7/2012	Chang
8,357,263	B2	1/2013	Berkoh et al.
8,373,264	B2	2/2013	Welch et al.
8,399,972	B2	3/2013	Hoang et al.
8,415,770	B2	4/2013	Riege et al.
8,415,805	B2	4/2013	Shen
8,521,101	B1	8/2013	Kadam et al.
8,542,061	B2	9/2013	Levesque et al.
8,559,898	B2	10/2013	Jones et al.
8,565,694	B2	10/2013	Jones et al.
8,571,492	B2	10/2013	Berchtold et al.
8,686,537	B2	4/2014	Sun et al.
8,719,459	B2	5/2014	Ripley
8,791,719	B2	7/2014	Ripley
8,797,103	B2	8/2014	Kaczman et al.
8,889,995	B2	11/2014	Sun et al.
8,896,091	B2	11/2014	Sun et al.