



(12) **United States Patent**  
**Severinsky et al.**

(10) **Patent No.:** **US 7,104,347 B2**  
(45) **Date of Patent:** **Sep. 12, 2006**

(54) **HYBRID VEHICLES**

FOREIGN PATENT DOCUMENTS

(75) Inventors: **Alex J. Severinsky**, Washington, DC (US); **Theodore Louckes**, Holly, MI (US)  
(73) Assignee: **Paice LLC**, Boca Raton, FL (US)  
(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 263 days.

DE	2517110	10/1975
DE	1905641	6/1976
DE	19814402	3/1998
DE	19838853	8/1998
EP	136055	3/1985
EP	0136055	3/1985
EP	510582	10/1992
EP	0510582	12/1995
EP	0743211	5/1996
EP	0769403	4/1997

(21) Appl. No.: **10/382,577**

(Continued)

(22) Filed: **Mar. 7, 2003**

OTHER PUBLICATIONS

(65) **Prior Publication Data**

US 2003/0217876 A1 Nov. 27, 2003

Simanaitis, "Electric Vehicles", *Road & Track*, May 1992, pp. 126-136.  
Reynolds, "AC Propulsion CRX", *Road & Track*, Oct. 1992, pp. 126-129.  
Kalberlah, "Electric Hybrid Drive Systems . . .", SAE Paper No. 910247, 1991.

**Related U.S. Application Data**

(Continued)

(60) Division of application No. 09/822,866, filed on Apr. 2, 2001, now Pat. No. 6,554,088, which is a continuation-in-part of application No. 09/392,743, filed on Sep. 9, 1999, now Pat. No. 6,338,391, which is a continuation-in-part of application No. 09/264,817, filed on Mar. 9, 1999, now Pat. No. 6,209,672.  
(60) Provisional application No. 60/122,296, filed on Mar. 1, 1999, and provisional application No. 60/100,095, filed on Sep. 14, 1998.

*Primary Examiner*—David R. Dunn  
(74) *Attorney, Agent, or Firm*—Michael de Angeli

(51) **Int. Cl.**  
**B60K 6/02** (2006.01)

(57) **ABSTRACT**

(52) **U.S. Cl.** ..... **180/65.2; 180/65.4; 701/54**  
(58) **Field of Classification Search** ..... **180/65.2, 180/65.3, 65.4, 65.8, 165; 60/706, 711, 716, 60/718; 290/17, 40 R, 40 C; 322/16; 477/2, 477/3; 701/54**  
See application file for complete search history.

A hybrid vehicle comprises an internal combustion engine, a traction motor, a starter motor, and a battery bank, all controlled by a microprocessor in accordance with the vehicle's instantaneous torque demands so that the engine is run only under conditions of high efficiency, typically only when the load is at least equal to 30% of the engine's maximum torque output. In some embodiments, a turbo-charger may be provided, activated only when the load exceeds the engine's maximum torque output for an extended period; a two-speed transmission may further be provided, to further broaden the vehicle's load range. A hybrid brake system provides regenerative braking, with mechanical braking available in the event the battery bank is fully charged, in emergencies, or at rest; a control mechanism is provided to control the brake system to provide linear brake feel under varying circumstances.

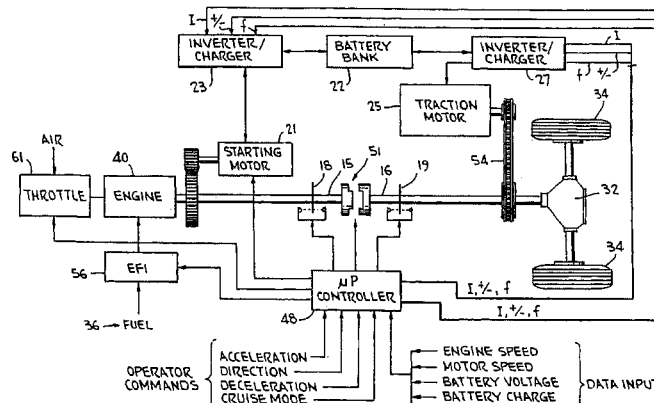
(56) **References Cited**

U.S. PATENT DOCUMENTS

913,846 A	3/1909	Pieper
1,824,014 A	9/1931	Froelich
2,666,492 A	1/1954	Nims et al.

(Continued)

**41 Claims, 17 Drawing Sheets**



U.S. PATENT DOCUMENTS					
			4,815,334	A	3/1989 Lexen
			4,862,009	A	8/1989 King
			4,923,025	A	5/1990 Ellers
			4,951,769	A	8/1990 Kawamura
			4,953,646	A	9/1990 Kim
			5,000,003	A	3/1991 Wicks
			5,053,632	A	10/1991 Suzuki et al.
			5,081,365	A	1/1992 Field et al.
			5,117,931	A	6/1992 Nishida
			5,120,282	A	6/1992 Fjällström
			5,125,469	A	6/1992 Scott
			5,141,173	A	8/1992 Lay
			5,172,784	A	12/1992 Varela, Jr.
			5,176,213	A	1/1993 Kawai et al.
			5,193,634	A	3/1993 Masut
			5,212,431	A	5/1993 Origuchi et al.
			5,242,335	A	9/1993 Kutter
			5,249,637	A	10/1993 Heidl et al.
			5,253,929	A	10/1993 Ohori
			5,255,733	A	10/1993 King
			5,258,651	A	11/1993 Sherman
			5,264,764	A	11/1993 Kuang
			5,283,470	A	2/1994 Hadley et al.
			5,291,960	A	3/1994 Brandenburg et al.
			5,301,764	A	4/1994 Gardner
			5,318,142	A	6/1994 Bates et al.
			5,323,688	A	6/1994 Walker
			5,323,868	A	6/1994 Kawashima
			5,326,158	A	7/1994 Ohori
			5,327,987	A	7/1994 Abdelmalek
			5,327,992	A	7/1994 Boll
			5,336,932	A	8/1994 Barske
			5,337,848	A	8/1994 Bader
			5,343,970	A	9/1994 Severinsky ..... 180/65.2
			5,345,154	A	9/1994 King
			5,345,761	A	9/1994 King et al.
			5,346,031	A	9/1994 Gardner
			5,350,031	A	9/1994 Sugiyama et al.
			5,371,412	A	12/1994 Iwashita et al.
			5,372,213	A	12/1994 Hasebe et al.
			5,384,521	A	1/1995 Coe
			5,403,244	A	4/1995 Tankersley
			5,406,126	A	4/1995 Hadley et al.
			5,412,251	A	5/1995 Furutani
			5,412,293	A	5/1995 Minesawa et al.
			5,415,245	A	5/1995 Hammond
			5,415,603	A	5/1995 Tuzuki et al.
			5,427,196	A	6/1995 Yamaguchi et al.
			5,428,274	A	6/1995 Furutani et al.
			5,433,282	A	7/1995 Moroto et al.
			5,441,122	A	8/1995 Yoshida
			5,457,363	A	10/1995 Yoshii et al.
			5,463,294	A	10/1995 Valdivia
			5,473,228	A	12/1995 Nii
			5,476,151	A	12/1995 Tsuchida et al.
			5,489,001	A	2/1996 Yang
			5,492,189	A	2/1996 Kreigler et al.
			5,492,190	A	2/1996 Yoshida
			5,492,192	A	2/1996 Brooks et al.
			5,495,906	A	3/1996 Furutani
			5,495,907	A	3/1996 Data
			5,495,912	A	3/1996 Gray, Jr. et al.
			5,497,941	A	3/1996 Numazawa et al.
			5,513,718	A	5/1996 Suzuki et al.
			5,513,719	A	5/1996 Moroto et al.
			5,515,937	A	5/1996 Adler et al.
			5,539,318	A	7/1996 Sasaki
			5,545,928	A	8/1996 Kotani
			5,547,433	A	8/1996 Yang
3,211,249	A	10/1965 Papst			
3,454,122	A	7/1969 Grady, Jr.			
3,502,165	A	3/1970 Matsukata			
3,525,874	A	8/1970 Toy			
3,566,717	A	3/1971 Berman et al.			
3,620,323	A	11/1971 Maeda			
3,623,568	A	11/1971 Mori			
3,650,345	A	3/1972 Yardney			
3,699,351	A	10/1972 Addie			
3,719,881	A	3/1973 Shibata et al.			
3,732,751	A	5/1973 Berman et al.			
3,753,059	A	8/1973 Berman			
3,790,816	A	2/1974 Berman			
3,791,473	A	2/1974 Rosen			
3,837,419	A	9/1974 Nakamura			
3,874,472	A	4/1975 Deane			
3,888,325	A	6/1975 Reinbeck			
3,904,883	A	9/1975 Horwinski			
3,923,115	A	12/1975 Helling			
3,970,163	A	7/1976 Kinoshita			
4,042,056	A	8/1977 Horwinski			
4,090,577	A	5/1978 Moore			
4,095,664	A	6/1978 Bray			
4,099,589	A	7/1978 Williams			
4,126,200	A	11/1978 Miller et al.			
4,148,192	A	4/1979 Cummings			
4,165,795	A	8/1979 Lynch et al.			
4,180,138	A	12/1979 Shea			
4,187,436	A	2/1980 Etienne			
4,216,684	A	8/1980 Hagin et al.			
4,233,858	A	11/1980 Rowlett			
4,269,280	A	5/1981 Rosen			
4,287,792	A	9/1981 Dailey			
4,305,254	A	12/1981 Kawakatsu			
4,306,156	A	12/1981 Monaco et al.			
4,313,080	A	1/1982 Park			
4,331,911	A	5/1982 Park			
4,335,429	A	6/1982 Kawakatsu			
4,351,405	A	9/1982 Fields et al.			
4,354,144	A	10/1982 McCarthy			
4,400,997	A	8/1983 Fiala			
4,405,029	A	9/1983 Hunt			
4,407,132	A	10/1983 Kawakatsu			
4,411,171	A	10/1983 Fiala			
4,416,360	A	11/1983 Fiala			
4,438,342	A	3/1984 Kenyon			
4,439,989	A	4/1984 Yamakawa			
4,444,285	A	4/1984 Stewart et al.			
4,470,476	A	9/1984 Hunt			
4,495,451	A	1/1985 Barnard			
4,511,012	A	4/1985 Rauneker			
4,533,011	A	8/1985 Heidemeyer			
4,562,894	A	1/1986 Yang			
4,578,955	A	4/1986 Medina			
4,583,505	A	4/1986 Frank et al.			
4,588,040	A	5/1986 Albright, Jr. et al.			
4,591,016	A	5/1986 Matthews			
4,592,454	A	6/1986 Michel			
4,593,779	A	6/1986 Krohling			
4,597,463	A	7/1986 Barnard			
4,611,466	A	9/1986 Keedy			
4,631,456	A	12/1986 Drescher et al.			
4,646,896	A	3/1987 Hammond et al.			
4,674,280	A	6/1987 Stuhr			
4,680,986	A	7/1987 Elsner			
4,697,660	A	10/1987 Wu et al.			
4,753,078	A	6/1988 Gardner			
4,762,191	A	8/1988 Hagin et al.			

5,558,173 A	9/1996	Sherman	5,789,877 A	8/1998	Yamada et al.
5,558,175 A	9/1996	Sherman	5,789,881 A	8/1998	Egami et al.
5,558,588 A	9/1996	Schmidt	5,789,882 A	8/1998	Ibaraki et al.
5,558,595 A	9/1996	Schmidt et al.	5,789,935 A	8/1998	Suga et al.
5,562,565 A	10/1996	Moroto et al.	5,791,426 A	8/1998	Yamada
5,562,566 A	10/1996	Yang	5,791,427 A	8/1998	Yamaguchi et al.
5,565,711 A	10/1996	Hagiwara	5,799,744 A	9/1998	Yamaguchi et al.
5,566,774 A	10/1996	Yoshida	5,801,497 A	9/1998	Shamoto et al.
5,568,023 A	10/1996	Grayer et al.	5,804,947 A	9/1998	Nii et al.
5,569,995 A	10/1996	Kusaka et al.	5,806,617 A	9/1998	Yamaguchi et al.
5,570,615 A	11/1996	Westphal et al.	5,816,358 A	10/1998	Adler et al.
5,586,613 A	12/1996	Ehsani	5,818,116 A	10/1998	Nakae et al.
5,588,498 A	12/1996	Kitada	5,820,172 A	10/1998	Brigham et al.
5,589,743 A	12/1996	King	5,823,280 A	10/1998	Lateur ..... 80/65.2
5,608,308 A	3/1997	Kiuchi et al.	5,823,281 A	10/1998	Yamaguchi et al.
5,614,809 A	3/1997	Kiuchi et al.	5,826,671 A	10/1998	Nakae et al.
5,621,304 A	4/1997	Kiuchi et al.	5,831,341 A	11/1998	Selfors et al.
5,623,194 A	4/1997	Boll	5,833,022 A	11/1998	Welke
5,632,352 A	5/1997	Jeanneret et al.	5,833,570 A	11/1998	Tabata
5,635,805 A	6/1997	Ibaraki et al.	5,839,530 A	11/1998	Dietzel
5,637,977 A	6/1997	Saito et al.	5,839,533 A	11/1998	Mikami et al.
5,637,987 A	6/1997	Fattic et al.	5,841,201 A	11/1998	Tabata et al.
5,643,119 A	7/1997	Yamaguchi et al.	5,842,534 A	12/1998	Frank ..... 180/65.2
5,644,200 A	7/1997	Yang	5,844,342 A	12/1998	Miyatani et al.
5,650,713 A	7/1997	Takeuchi et al.	5,845,731 A	12/1998	Buglione et al. .... 180/65.2
5,650,931 A	7/1997	Nii	5,846,155 A	12/1998	Taniguchi et al.
5,653,302 A	8/1997	Edye et al.	5,847,469 A	12/1998	Tabata
5,656,921 A	8/1997	Farrall	5,851,698 A	12/1998	Reichmann et al.
5,660,077 A	8/1997	Nekola	5,856,047 A	1/1999	Venkatesan et al.
5,664,635 A	9/1997	Koga et al.	5,856,709 A	1/1999	Ibaraki et al.
5,667,029 A	9/1997	Urban et al.	5,862,497 A	1/1999	Yano et al.
5,669,842 A	9/1997	Schmidt	5,865,263 A	2/1999	Yamaguchi et al.
5,672,920 A	9/1997	Donegan et al.	5,873,426 A	2/1999	Tabata
5,675,203 A	10/1997	Schulze et al.	5,875,691 A	3/1999	Hata
5,675,222 A	10/1997	Fliege	5,883,484 A	3/1999	Akao
5,678,646 A	10/1997	Fliege	5,883,496 A	3/1999	Esaki et al.
5,679,087 A	10/1997	Lutz	5,887,670 A	3/1999	Tabata et al.
5,680,050 A	10/1997	Kawai et al.	5,887,674 A	3/1999	Gray
5,685,798 A	11/1997	Lutz	5,890,470 A	4/1999	Woon
5,691,588 A	11/1997	Lutz	5,890,555 A	4/1999	Miller
5,697,466 A	12/1997	Moroto et al. .... 180/65.2	5,893,895 A	4/1999	Ibaraki
5,698,905 A	12/1997	Ruthlein et al.	5,895,100 A	4/1999	Ito et al.
5,698,955 A	12/1997	Nii	5,895,333 A	4/1999	Morisawa
5,704,440 A	1/1998	Urban et al.	5,898,282 A	4/1999	Drozdz et al.
5,705,859 A	1/1998	Karg et al.	5,899,286 A	5/1999	Yamaguchi et al.
5,713,425 A	2/1998	Buschhaus et al.	5,904,631 A	5/1999	Morisawa et al.
5,713,426 A	2/1998	Okamura	5,905,360 A	5/1999	Ukita
5,713,427 A	2/1998	Lutz	5,907,191 A	5/1999	Sasaki et al.
5,713,814 A	2/1998	Hara et al.	5,908,077 A	6/1999	Moore
5,714,851 A	2/1998	Antony et al.	5,909,720 A	6/1999	Yamaoka et al.
5,722,502 A	3/1998	Kubo	5,914,575 A	6/1999	Sasaki
5,722,911 A	3/1998	Ibaraki et al.	5,915,488 A	6/1999	Fliege
5,725,064 A	3/1998	Ibaraki et al.	5,915,489 A	6/1999	Yamaguchi
5,755,302 A	5/1998	Lutz	5,923,093 A	7/1999	Tabata
5,755,303 A	5/1998	Yamamoto et al.	5,924,395 A	7/1999	Moriya et al.
5,757,151 A	5/1998	Donegan et al.	5,927,415 A	7/1999	Ibaraki et al.
5,767,637 A	6/1998	Lansberry	5,927,417 A	7/1999	Brunner et al. .... 180/65.6
5,771,478 A	6/1998	Tsukamoto	5,928,301 A	7/1999	Soga et al.
5,773,904 A	6/1998	Schiebold et al.	5,929,594 A	7/1999	Nonobe et al.
5,775,449 A	7/1998	Moroto et al.	5,931,271 A	8/1999	Haka
5,778,326 A	7/1998	Moroto et al.	5,934,395 A	8/1999	Koide et al. .... 180/65.2
5,778,997 A	7/1998	Setaka et al.	5,935,040 A	8/1999	Tabata et al.
5,785,136 A	7/1998	Falkenmayer et al.	5,943,918 A	8/1999	Reed, Jr. et al.
5,785,137 A	7/1998	Reuyl	5,944,630 A	8/1999	Omote
5,785,138 A	7/1998	Yoshida	5,947,855 A	9/1999	Weiss
5,786,640 A	7/1998	Sakai et al.	5,951,115 A	9/1999	Sakai et al.
5,788,003 A	8/1998	Spiers	5,951,118 A	9/1999	Soejima
5,788,004 A	8/1998	Friedmann et al.	5,951,614 A	9/1999	Tabata
5,788,006 A	8/1998	Yamaguchi et al.	5,964,309 A	10/1999	Kimura et al.

5,971,088	A	10/1999	Smith	6,232,733	B1	5/2001	Obayashi et al.	
5,971,092	A	10/1999	Walker	6,232,748	B1	5/2001	Kinoshita et al.	
5,973,460	A	10/1999	Taga, deceased et al.	6,247,437	B1	6/2001	Yamaguchi et al.	
5,973,463	A	10/1999	Okuda et al.	6,253,865	B1	7/2001	Suzuki	
5,979,158	A	11/1999	Kaiser	6,258,001	B1	7/2001	Wakuta	
5,979,257	A	11/1999	Lawrie	6,260,644	B1	7/2001	Otsu	
5,982,045	A	11/1999	Tabata et al.	6,265,692	B1	7/2001	Umebayahi et al.	
5,983,740	A	11/1999	Salecker et al.	6,278,195	B1	8/2001	Yamaguchi et al.	
5,984,034	A	11/1999	Morisawa	6,278,915	B1	8/2001	Deguchi et al.	
5,984,432	A	11/1999	Otomo et al.	6,281,660	B1	8/2001	Abe	
5,986,376	A	11/1999	Werson	6,291,953	B1	9/2001	Lovatt et al.	
5,988,307	A	11/1999	Yamada et al.	6,300,735	B1	10/2001	Stemler	
5,991,683	A	11/1999	Takaoka et al.	6,306,057	B1	10/2001	Morisawa	
5,993,169	A	11/1999	Adachi et al.	6,307,276	B1	10/2001	Bader	
5,993,350	A	11/1999	Lawrie et al.	6,315,068	B1	* 11/2001	Hoshiya et al. ....	180/65.2
5,993,351	A	11/1999	Deguchi et al. ....	6,317,665	B1	11/2001	Tabata et al.	
5,996,347	A	12/1999	Nagae et al.	6,318,487	B1	11/2001	Yanase et al.	
6,003,626	A	12/1999	Ibaraki et al.	6,321,150	B1	11/2001	Nitta	
6,005,297	A	12/1999	Sasaki et al.	6,328,122	B1	12/2001	Yamada	
6,006,149	A	12/1999	Salecker et al.	6,328,670	B1	12/2001	Minowa	
6,006,620	A	12/1999	Lawrie et al.	6,328,671	B1	12/2001	Nakajima	
6,007,443	A	12/1999	Onimaru	6,330,498	B1	* 12/2001	Tamagawa et al. ....	701/22
6,007,451	A	12/1999	Matsui et al.	6,332,257	B1	12/2001	Reed, Jr. et al.	
6,009,365	A	12/1999	Takahara et al.	6,334,498	B1	1/2002	Morisawa	
6,018,198	A	1/2000	Tsuzuki et al.	6,338,391	B1	1/2002	Severinsky et al.	
6,018,694	A	1/2000	Egami et al. ....	6,340,339	B1	1/2002	Tabata	701/102
6,019,698	A	2/2000	Lawrie et al.	6,344,008	B1	2/2002	Nagano	
6,026,921	A	2/2000	Aoyama et al. ....	6,357,541	B1	3/2002	Matsuda et al.	180/65.2
6,032,753	A	3/2000	Yamazaki et al.	6,359,404	B1	* 3/2002	Sugiyama et al. ....	318/432
6,041,877	A	3/2000	Yamada et al.	6,387,007	B1	5/2002	Fini	
6,044,922	A	4/2000	Field	6,394,209	B1	5/2002	Goehring et al.	
6,048,289	A	4/2000	Hattori et al. ....	6,435,296	B1	8/2002	Arai	180/65.2
6,053,841	A	4/2000	Koide et al.	6,470,983	B1	* 10/2002	Amano et al. ....	180/65.2
6,053,842	A	4/2000	Kitada et al. ....	6,481,516	B1	11/2002	Field et al.	477/5
6,054,844	A	4/2000	Frank ..... 322/16	6,563,230	B1	5/2003	Nada	
RE36,678	E	5/2000	Moroto et al.	6,592,484	B1	7/2003	Tsai	
6,059,059	A	5/2000	Schmidt-Brucken	2001/0037905	A1	11/2001	Nogi et al.	
6,059,064	A	5/2000	Nagano et al.	2003/0085577	A1	5/2003	Takaoka et al.	
6,064,161	A	5/2000	Takahara					
6,067,801	A	5/2000	Harada et al.					
6,070,680	A	6/2000	Oyama					
6,074,321	A	6/2000	Maeda et al.					
6,077,186	A	6/2000	Kojima et al.					
6,081,042	A	6/2000	Tabata et al.					
6,087,734	A	7/2000	Maeda et al.					
6,090,007	A	7/2000	Nakajima					
6,098,733	A	8/2000	Ibaraki et al.					
6,109,025	A	8/2000	Murata et al.					
6,110,066	A	8/2000	Nedungadi et al.					
6,116,363	A	9/2000	Frank					
6,119,799	A	9/2000	Morisawa					
6,123,163	A	9/2000	Otsu et al.					
6,123,642	A	9/2000	Saito					
6,131,538	A	10/2000	Kanai					
6,131,680	A	10/2000	Nii et al.					
6,135,914	A	10/2000	Yamaguchi et al.					
6,142,907	A	11/2000	Minowa					
6,146,302	A	11/2000	Kashiwase					
6,155,364	A	12/2000	Nagano et al.					
6,158,541	A	12/2000	Tabata					
6,161,384	A	12/2000	Reinbold et al.					
6,166,499	A	12/2000	Kanamori et al.					
6,170,587	B1	1/2001	Bullock					
6,176,807	B1	1/2001	Oba et al.					
6,183,389	B1	2/2001	Tabata et al.					
6,190,282	B1	2/2001	Deguchi et al.					
6,203,468	B1	3/2001	Nitta					
6,204,636	B1	3/2001	Kinoshita et al.					
6,209,672	B1	4/2001	Severinsky					

FOREIGN PATENT DOCUMENTS

EP	0839683	10/1997
FR	2419832	3/1978
JP	S4849115	10/1971
JP	S5030223	7/1973
JP	4864626	9/1973
JP	4929642	8/1974
JP	5110322	2/1975
JP	51103220	8/1976
JP	5355105	5/1978
JP	55069724	11/1978
JP	55110328	8/1980
JP	H564531	9/1984
JP	62113956	5/1987
JP	6382283	6/1988
JP	3124201	10/1989
JP	04274926	2/1991
JP	429733	3/1991
JP	3273933	5/1991
JP	467703	3/1992
JP	5319110	5/1992
JP	4244658	9/1992
JP	4297330	10/1992
JP	06080048	11/1992
JP	06144020	11/1992
JP	6245317	2/1993
JP	7172196	9/1994
JP	754983	2/1995
JP	7268922	10/1995
JP	9170533	5/1996

JP	11082260	3/1999
JP	11082261	3/1999
JP	11122712	4/1999
WO	WO 820117	4/1982
WO	8201170	4/1982
WO	WO 9924280	11/1997

## OTHER PUBLICATIONS

Bullock, "The Technological Constraints of Mass, Volume, Dynamic Power Range and Energy Capacity . . ." SAE Paper No. 891659 198.

Electric and Hybrid Vehicle Technology, vol. SP-915, SAE, Feb. 1992.

Wouk, "Hybrids: Then and Now", *IEEE Spectrum*, vol. 32, Jul. 7, 1995.

Bates, "Getting a Ford HEV on . . ." *IEEE Spectrum*, vol. 32, Jul. 7, 1995.

King et al, "Transit Bus takes . . ." *IEEE Spectrum*, vol. 32, Jul. 7, 1995.

Yamaguchi, "Toyota readies gasoline/electric hybrid system", *Automotive Engineering*, Jul. 1997, pp. 55-58.

Wilson, "Not Electric, Not Gasoline . . ." *Autoweek*, Jun. 2, 1997, pp. 17-18.

Bulgin, "The Future Works, Quietly", *Autoweek*, Feb. 23, 1998 pp. 12-13.

"Toyota Electric and Hybrid Vehicles", a Toyota brochure. Nagasaka et al, "Development of the Hybrid/Battery ECU . . .", SAE paper 981122, 1998, pp. 19-27.

Published application US 2001/0037805, Nogi et al, Nov. 2001.

Published patent application US 2003/0085577 of Takaoka et al, May 8, 2003.

Mayrhofer et al "A Hybrid Drive Based on a Structure Variable Arrangement" (1994).

"Diesel-Electric VW", *Popular Science*, Dec. 1990, p. 30.

"Electric Vehicles Only", *Popular Science*, May 1991, pp. 78-81 and 110.

"Lightweight, High-Energy Lead/Acid Battery" *NASA Tech Briefs*, Apr. 1991, 22-24.

Yamaguchi et al, "Dual System—Newly Developed Hybrid System" (incomplete).

Takaoka et al "A High-Expansion-Ratio Gasoline Engine for the Toyota Hybrid System", *Toyota Technical Review* vol. 47, No. 2, Apr. 1998.

Sasaki et al, "Toyota's Newly Developed Electric-Gasoline Hybrid Powertrain System" (publication data not available).

Ehsani et al "Propulsion System Design of Electric and Hybrid Vehicles", *IEEE Trans. Ind. Elec.*, 44 1 (1997).

Ehsani et al, "Parametric Design of the Drive Train of an Electrically Peaking Hybrid (ELPH) Vehicle", SAE paper 970294 (1997).

Yamaguchi et al, "Development of a New Hybrid System—Dual System", SAE papers 960231 (1996).

Winkelman et al, SAE paper 730511, "Computer Stimulation...." (1973).

Berman et al., *IEEE VT-23*, No. 3, pp. 61-72 "Propulsion Systems...." (1974).

Berman SPC-TUE-2 "Battery Powered Regenerative SCR Drive" (1970).

Gelb et al "Performance Analyses... " ACS pub (1972), pp. 977-988.

Berman SPC-TUE-1 "Design Considerations. . . ." (1971).

Minorikawa et al, "Current Status and Future Trends. . . ." (Undated).

Baum et al. "Semiconductor Technologies. . ." (Undated).

Chen "Automotive Electronics in the Year 2000. . ." (Apparently 1992).

Brusaglino, SAE paper 910244 "Electric Vehicle Development. . ." (1991).

Anderson et al, SAE paper 910246 "Integrated Electric. . ." (1991).

Burke, SAE paper 911914 "Battery Availability for Near-Term. . ." (1991).

Chang, *IEEE AES Magazine* (1993) "Recent Developments of Electric . . .".

Kamiyama et al, *IEEE 0-7803-0582-5* (1992) "Application Trends. . . .".

Sen, *IEEE Trans. Ind. Elec.* (1990) "Electric Motor Drives. . . .".

Wang et al, PCSC '71 Record, "Analysis of SCR Chopper Drive" (1971).

EPRI Report TR-101264 Assessment of Electric Motor Technology (1992).

Berman et al, SAE paper 720111 "Electric Car Drives. . . ." (1972).

Gelb et al, "The Application of Solid Electrolyte Batteries. . ." (Undated).

Miller, "Integrated Power Module Requirements for Automotive. . ." (Undated).

Vukosavic et al, *IEEE Trans. Ind. App.* "SRM Inverter Topologies. . ." (1991).

Trial and deposition transcripts of witnesses relied upon to assert invalidity of parent patents in Civil Docket No. 2:04-CV-211-DF (E.D. Texas).

Claim construction order entered Sep. 28, 2005 in Civil Docket No. 2:04-CV-211-DF (E.D. Texas).

Toyota Hybrid System, Toyota Press Information, Tokyo, 1997 Prius Hybrid EV, Toyota brochure, undated.

Miller et al, "Starter-Alternator for Hybrid Electric Vehicle.." (1996).

Johnston et al, "The Design and Development of the [UC Davis].." (No date).

Johnston et al, "The Design and Development of the [UC Davis].." (1997).

Alexander et al, "A Mid-Sized Sedan Designed for High-Fuel.." (No date).

"PRIUS New Car Features", (Toyota manual) (1998).

TRW Systems Group, "Analysis and Advanced Design Study.." (1971).

Gelb, "An Electromechanical Transmission for Hybrid Vehicle.." (1971).

Hirose et al, "The New High Expansion Ration Engine.." (1997).

Hong, "Toyota's Hybrid Program", *Road & Track*, Aug. 1997.

Law, "Toyota Tech ", *Car & Driver*, Aug. 1997.

"Dual-Engine Fuel Saver", *Popular Mechanics*, Jul. 1997.

"Toyota Launches Break-Through Hybrid EV", *Motor Trend*, Sep. 1997.

"Toyota touts advances in safety, emissions", *Automotive News*, Apr. 28, 1997.

"'96 North Wind Performance", undated.

Wakefield, "History of the Electric Automobile -Hybrid



# 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.