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(54) **BRUSHLESS DC MOTOR HAVING
MULTIPLE PARALLEL WINDINGS**

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H02K 16/04 (2006.01)

(52) **U.S. Cl.** **310/198**; 310/71; 310/112

(58) **Field of Classification Search** 310/71,
310/112-114, 159, 184, 179, 180, 198
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,273,782 A	7/1918	Hobart
1,497,448 A	2/1919	Keith
1,503,245 A	7/1924	Reed
1,915,778 A	9/1930	Dreese
3,611,088 A	10/1971	Hill
3,611,091 A	10/1971	Genovese
3,624,472 A	11/1971	Graham
3,633,055 A	1/1972	Maier
3,930,190 A	12/1975	Liska
4,208,620 A	6/1980	Ringland

4,329,122 A *	5/1982	Owada et al.	417/365
4,381,465 A	4/1983	Renkl et al.	
4,513,237 A	4/1985	Ford	
4,678,972 A	7/1987	Lehnhoff et al.	
4,918,347 A	4/1990	Takaba	
4,937,485 A	6/1990	Mihalko	
5,229,676 A *	7/1993	Bood	310/114

(Continued)

FOREIGN PATENT DOCUMENTS

WO 9949563 A1 9/1999

OTHER PUBLICATIONS

Munoz, Alfredo R. et al., "Dual Stator Winding Induction Machine Drive," IEEE Transactions on Industry Applications, vol. 36, No. 5, Sep./Oct. 2000, pp. 1369-1379.

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(57) **ABSTRACT**

A brushless DC motor has at least three stator sections and a single rotor rotating with the three stator sections. Each stator section is wound with three parallel windings having respective three nodes. Each stator section has nine terminals providing independent access to each node so that separate voltages and currents are applied to each parallel winding in the stator section. Thus, the current applied to each stator section is divided substantially equally among the three parallel windings, thereby reducing the current in each winding for the same power requirement for the motor, which reduces the I²R losses in the windings and the supply wiring and reduces the power handling requirements in the electronic switches providing the supply voltages. The three parallel windings are connected to external terminals of the motor to form either a delta winding configuration or a wye (star) winding configuration.

1 Claim, 5 Drawing Sheets

