



US006167610B1

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

(10) **Patent No.:** **US 6,167,610 B1**
(45) **Date of Patent:** ***Jan. 2, 2001**

(54) **METHOD OF MAKING A ROTARY MOTOR**

(56)

References Cited

(75) Inventors: **Yuji Nakahara; Ken-ichi Azuma; Masaru Matsumoto; Youichi Fujita,** all of Hyogo; **Satoru Akutsu,** Fukushima; **Akira Hashimoto,** Kanagawa; **Yasunori Takai,** Hyogo; **Tadashi Hasegawa; Hiroshi Miyazaki,** both of Fukushima; **Junji Kawada,** Kanagawa, all of (JP)

(73) Assignee: **Mitsubishi Denki Kabushiki Kaisha,** Tokyo (JP)

(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: **08/582,595**

(22) Filed: **Jan. 3, 1996**

Related U.S. Application Data

(62) Division of application No. 08/333,142, filed on Nov. 1, 1994, now Pat. No. 5,859,486.

(30) **Foreign Application Priority Data**

Nov. 8, 1993 (JP) 5-278562
Apr. 28, 1994 (JP) 6-92041
Aug. 5, 1994 (JP) 6-184802

(51) **Int. Cl.⁷** **H02K 15/09**

(52) **U.S. Cl.** **29/596; 29/606; 29/609; 310/42; 310/259**

(58) **Field of Search** **29/596, 598, 609, 29/606; 310/42, 43, 259**

U.S. PATENT DOCUMENTS

1,779,950	10/1930	Reichel	310/254
2,253,191	8/1941	Morrill .	
2,554,226	5/1951	Taylor	310/254
3,320,451	5/1967	Wiley	310/216
3,464,106	9/1969	Barrett .	
3,606,674	9/1971	Givan .	
3,710,158	1/1973	Bachle et al.	310/156
3,829,720	8/1974	Swanke et al.	310/43
3,909,643	9/1975	Kishima .	
4,102,040 *	7/1978	Rich	29/598
4,206,621	6/1980	Kawasaki et al.	72/130
4,350,914	9/1982	Searle	310/194
4,359,763	11/1982	Hoffman .	

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

1914317	9/1970	(DE) .	
32 23 897 A1	12/1983	(DE)	H02K/29/02

(List continued on next page.)

OTHER PUBLICATIONS

Austrian Search Report, issued for application No. 9601848-6.

* cited by examiner

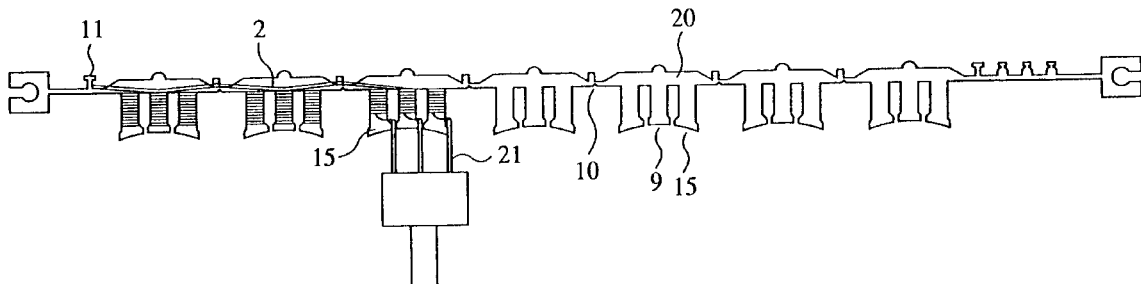
Primary Examiner—Carl E. Hall

(74) *Attorney, Agent, or Firm*—Wolf, Greenfield & Sacks, P.C.

(57) **ABSTRACT**

Magnetic materials which are divided into a plurality of blocks or divided corresponding to respective magnetic pole teeth are connected by means of thin portions. The respective magnetic pole teeth are wound continuously with wire without cutting the wire at the positions in which the thin portions are connected. When a stator is assembled, a plurality of blocks or magnetic pole teeth are disposed on a substrate by separating or bending the thin portions.

12 Claims, 107 Drawing Sheets



U.S. PATENT DOCUMENTS

4,363,987	12/1982	Vorotyntseva et al. .	56-80638	11/1954	(JP) .
4,365,180	* 12/1982	Licata et al. 29/598 X	50-122608	9/1975	(JP) .
4,384,226	5/1983	Sato et al. 310/89	50-132401	10/1975	(JP) .
4,402,129	* 9/1983	Kreuzer et al. 29/596	52-34301	* 3/1977	(JP) 29/596
4,519,010	5/1985	Elsaesser et al. 360/97	56-112838	9/1981	(JP) .
4,547,714	10/1985	Müller 318/254	56-117568	9/1981	(JP) .
4,593,223	6/1986	Lehoczky 310/258	57-068644	4/1982	(JP) .
4,754,178	6/1988	Kavanaugh 310/49 R	58-130751	8/1983	(JP) .
4,758,752	7/1988	Leenhouts 310/49 R	59-206188	11/1984	(JP) .
4,868,439	9/1989	King 310/217	60-46745	3/1985	(JP) .
4,882,832	11/1989	Lewis 29/596	61-124241	6/1986	(JP) .
5,047,745	9/1991	Marriott et al. 310/217	62-107833	5/1987	(JP) .
5,057,733	10/1991	Sonoda et al. 310/269	62-185462	11/1987	(JP) .
5,086,245	2/1992	Sieja et al. 310/216	63-21455	2/1988	(JP) .
5,113,104	5/1992	Blaettner et al. 310/90	63-87146	4/1988	(JP) .
5,124,863	6/1992	Koizumi et al. .	63-131567	8/1988	(JP) .
5,173,889	12/1992	Nagahisa et al. 369/37	01252141	* 6/1989	(JP) .
5,304,878	4/1994	Oda et al. 310/67 R	01252141	10/1989	(JP) .
5,319,270	6/1994	Tanaka et al. 310/67 R	01264548	10/1989	(JP) .
5,457,873	10/1995	Cattaneo 29/606	1-252141	10/1989	(JP) .
5,477,096	12/1995	Sakashita et al. 310/216	1-159557	11/1989	(JP) .
5,489,811	2/1996	Kern et al. 310/216	2-52127	2/1990	(JP) .
5,592,731	* 1/1997	Huang et al. 29/596	2-123933	5/1990	(JP) .
			2-179247	7/1990	(JP) .
			2-211035	8/1990	(JP) .
			2-29800	8/1990	(JP) H02K/5/04
			4-42760	2/1992	(JP) .
			4-134291	4/1992	(JP) .
			4-147776	5/1992	(JP) .
			4-178149	6/1992	(JP) .
			4-178157	6/1992	(JP) .
			4-80276	6/1992	(JP) .
			04298013	10/1992	(JP) .
			05003648	1/1993	(JP) .
			5-9171	2/1993	(JP) .
			05095643	4/1993	(JP) .
			05283833	10/1993	(JP) .
			5-292708	11/1993	(JP) .
			5-86151	11/1993	(JP) G11B/19/20

FOREIGN PATENT DOCUMENTS

3408394	9/1985	(DE) .
3 629 423 A1	3/1988	(DE) H02K/29/00
3629423	3/1988	(DE) .
3639004	5/1988	(DE) .
4 117 801 A1	12/1991	(DE) H02K/21/14
0097756	1/1984	(EP) .
0160147	11/1985	(EP) .
0 445 367 A1	9/1991	(EP) H02K/1/16
2201575	4/1974	(FR) .
2219508	9/1974	(FR) .
1129932	3/1967	(GB) .
2245108	12/1991	(GB) .
55-48392	9/1953	(JP) .

FIG.1

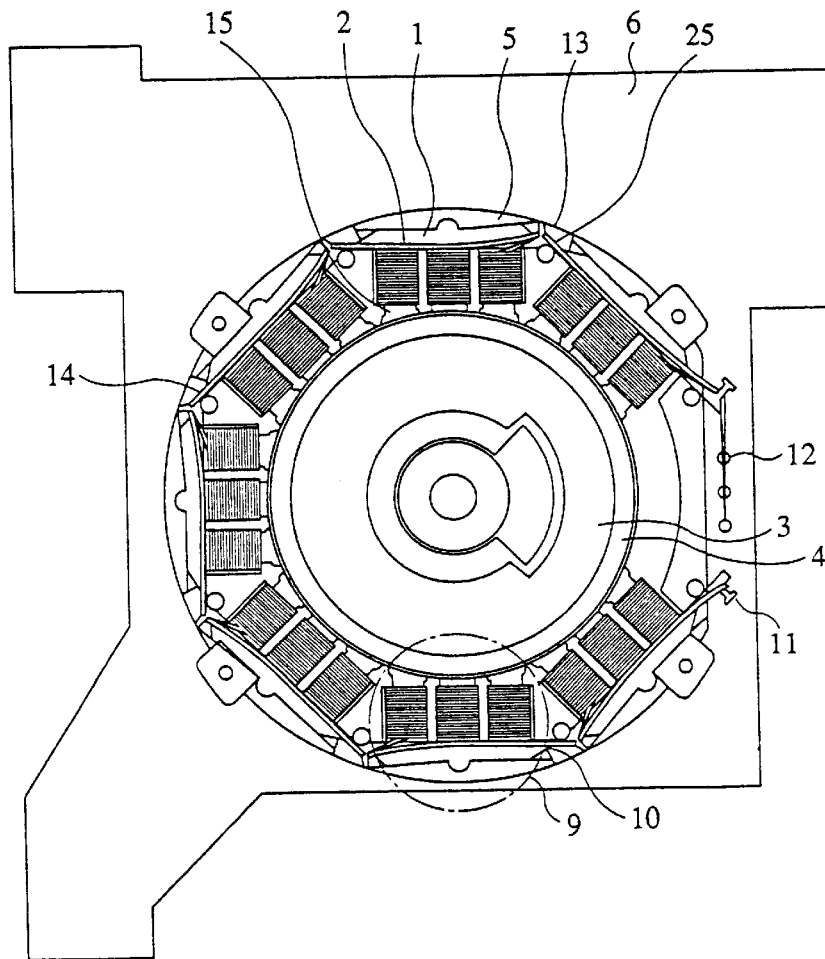


FIG.2

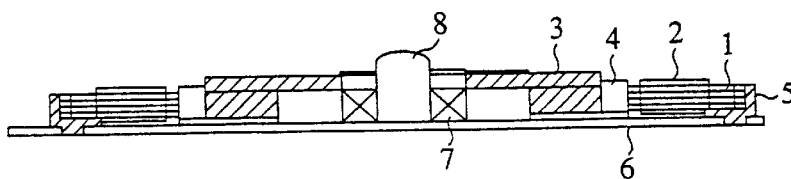


FIG.3

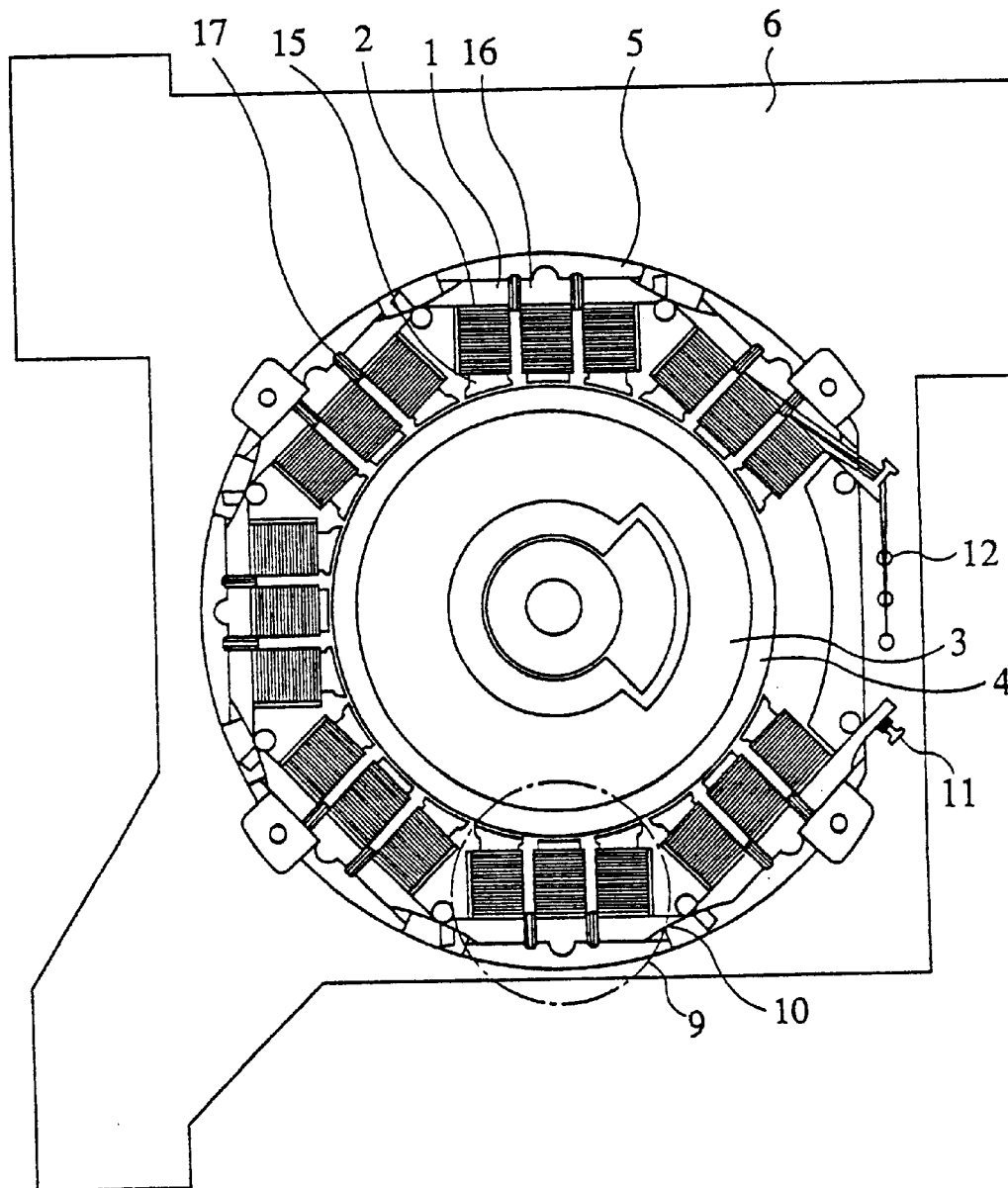


FIG.4

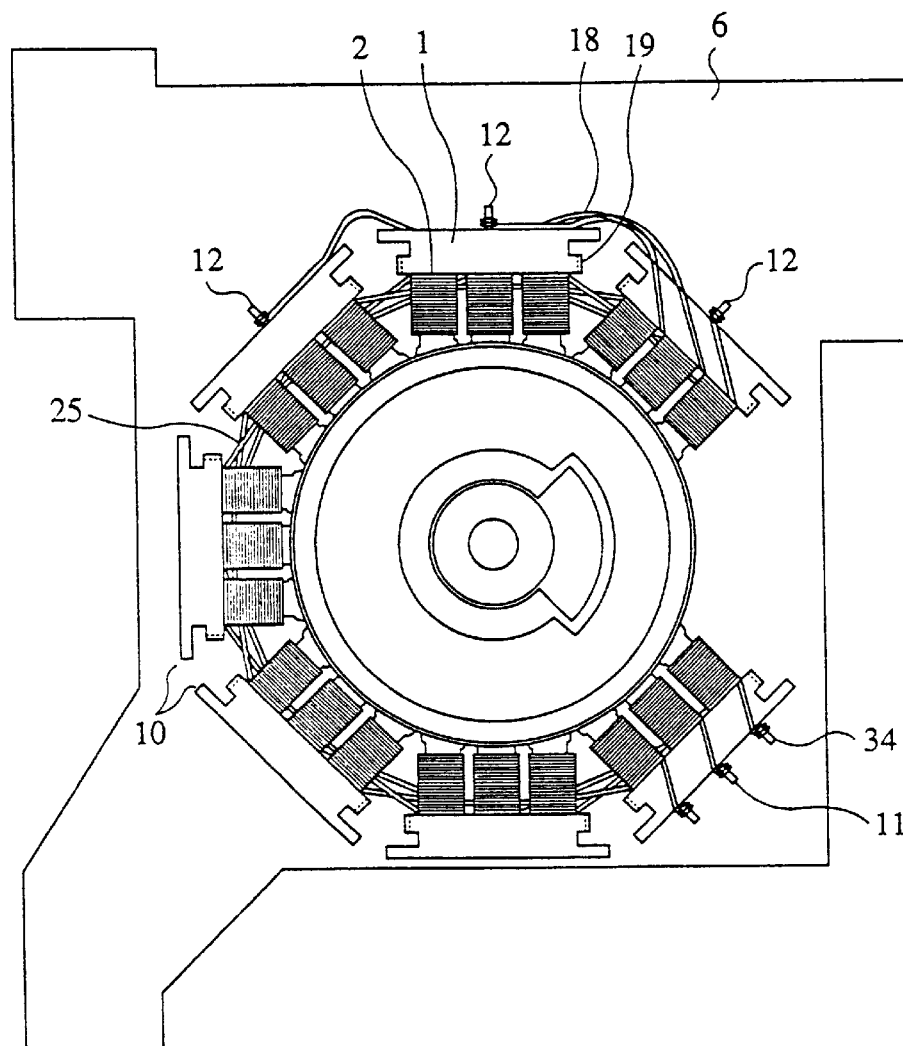
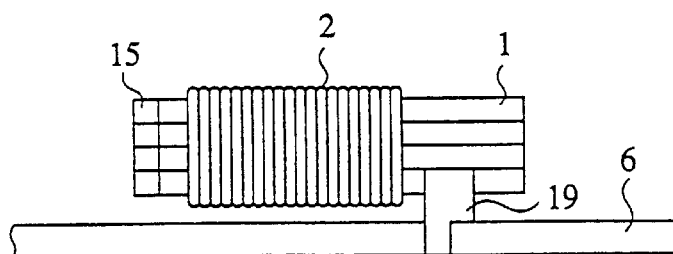


FIG.5



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.