

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
8 February 2007 (08.02.2007)

PCT

(10) International Publication Number
WO 2007/016336 A3

(51) International Patent Classification:

F16H 1/28 (2006.01) **F16H 1/48** (2006.01)
F16H 57/08 (2006.01)

(74) Agent: **BOESCHENSTEIN, Edward**; Polster, Lieder,
Woodruff & Lucchesi, L.C., 12412 Powerscourt Drive, St.
Louis, Missouri 63131 (US).

(21) International Application Number:

PCT/US2006/029395

(22) International Filing Date: 27 July 2006 (27.07.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/704,329 1 August 2005 (01.08.2005) US

(71) Applicant (for all designated States except US): **THE
TIMKEN COMPANY** [US/US]; 1835 Dueber Avenue
S.W., Canton, Ohio 44706-0930 (US).

(72) Inventor; and

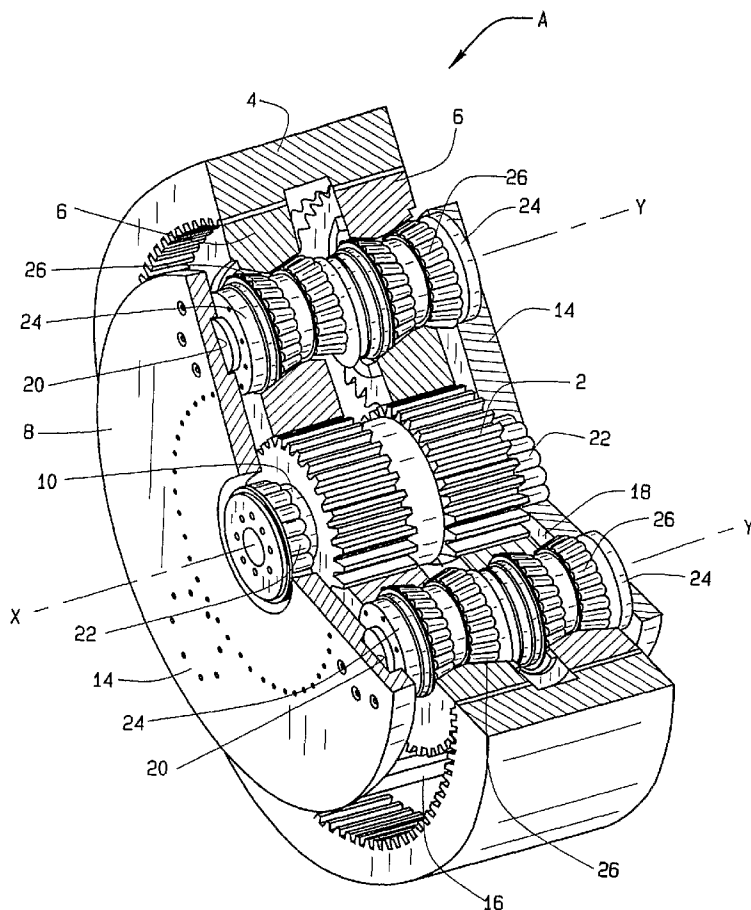
(75) Inventor/Applicant (for US only): **FOX, Gerald**
[US/US]; 5715 Old Bridge, Massillon, Ohio 44706 (US).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP,
KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT,
LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA,
NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC,
SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ,
UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,

[Continued on next page]

(54) Title: EPICYCLIC GEAR SYSTEM WITH FLEXPINS



(57) Abstract: An epicyclic gear system (A) includes a sun gear (2), a ring gear (4) located around the sun gear, planet gears (6) organized in two arrays between the sun and ring gears, and a carrier (8) having walls (14) located beyond the planet gears and flexpins (24) that project from the walls into the planet gears. Each flexpin includes an inner pin (30) provided with a flange (36) that is secured to the wall from which the inner pin projects, thus cantilevering the inner pin from the wall, and a sleeve (32) that is cantilevered from the opposite end of the inner pin and extends back over the inner pin, thus providing a double cantilever. Between the sleeve of the flexpin and the planet gear for that flexpin is a double row tapered roller bearing (26). The planet gears on the one array may be offset angularly with respect to the planet gears of the other array.



RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
- *of inventorship (Rule 4.17(iv))*

Published:

- *with international search report*

(88) Date of publication of the international search report:
24 May 2007

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/029395

A. CLASSIFICATION OF SUBJECT MATTER

INV. F16H1/28 F16H57/08 F16H1/48

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F16H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 943 787 A (HICKS RAYMOND JOHN) 16 March 1976 (1976-03-16) column 2, line 43 - line 60	1-3,11
A	figures 1,2 -----	4,6,7,10
X	US 6 117 041 A (AVERY BENNETT W [US] ET AL) 12 September 2000 (2000-09-12)	1,11
A	the whole document	2,4,6,7, 10
A	----- WO 2005/005866 A (TIMKEN CO [US]; FOX GERALD P [US]) 20 January 2005 (2005-01-20) page 3, line 28 - page 4, line 8 figure 2 ----- -/-	1,11

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

28 November 2006

Date of mailing of the international search report

20. 03. 2007

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Truchot, Alexandre

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/029395

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2005/050058 A (HANSEN TRANSMISSIONS INT [BE]; SMOOK WARREN [BE]; BOGAERT ROGER [BE]) 2 June 2005 (2005-06-02) page 4, line 4 - line 8 page 5, line 3 - page 6, line 27 figures 1,4-6 -----	1,11
A	WO 2004/067998 A (TIMKEN CO [US]; FOX GERALD P [US]) 12 August 2004 (2004-08-12) page 6, line 30 - page 8, line 4 figures 2-5 -----	1
A	US 2003/008748 A1 (FOX GERALD [US]) 9 January 2003 (2003-01-09) paragraph [0017]; figure 2 -----	1
A	US 2005/075211 A1 (FOX GERALD P [US] ET AL) 7 April 2005 (2005-04-07) paragraph [0016]; figure 2 -----	1
A	JP 57 018838 A (SUMITOMO METAL IND) 30 January 1982 (1982-01-30) abstract; figures 1-4 -----	1
A	US 3 983 764 A (HICKS RAYMOND JOHN) 5 October 1976 (1976-10-05) the whole document -----	1
A	US 3 303 713 A (HICKS RAYMOND J) 14 February 1967 (1967-02-14) column 2, line 49 - line 52 figure 1 -----	1
A	FR 2 166 690 A (SNECMA) 17 August 1973 (1973-08-17) page 2, line 28 - page 3, line 24 figure 2 -----	1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2006/029395

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-11

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-11

Epicyclic gear system wherein flexpins are attached to a carrier wall via flanges.

2. claims: 12,13

Epicyclic gear system wherein the two arrays of planet gears are offset angularly with respect to each other.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2006/029395

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3943787	A	16-03-1976	CA 1002786 A1 DE 2517225 A1 FR 2268202 A1 GB 1448059 A JP 50139253 A	04-01-1977 06-11-1975 14-11-1975 02-09-1976 07-11-1975
US 6117041	A	12-09-2000	NONE	
WO 2005005866	A	20-01-2005	EP 1639276 A1	29-03-2006
WO 2005050058	A	02-06-2005	AU 2004291730 A1 CA 2535318 A1 CN 1849468 A EP 1685337 A1	02-06-2005 02-06-2005 18-10-2006 02-08-2006
WO 2004067998	A	12-08-2004	AT 332457 T DE 602004001447 T2 EP 1588074 A1 JP 2006516713 T	15-07-2006 22-02-2007 26-10-2005 06-07-2006
US 2003008748	A1	09-01-2003	DE 60205746 D1 DE 60205746 T2 EP 1399682 A1 JP 2004531680 T WO 03002891 A1	29-09-2005 14-06-2006 24-03-2004 14-10-2004 09-01-2003
US 2005075211	A1	07-04-2005	EP 1673553 A1 WO 2005038296 A1	28-06-2006 28-04-2005
JP 57018838	A	30-01-1982	JP 1465858 C JP 63011545 B	10-11-1988 15-03-1988
US 3983764	A	05-10-1976	NONE	
US 3303713	A	14-02-1967	DE 1500451 A1 GB 1101131 A	08-05-1969 31-01-1968
FR 2166690	A	17-08-1973	NONE	