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(71) Applicant (for all designated States except US): **PARKER-HANNIFIN CORPORATION** [US/US]; 6035 Parkland Boulevard, Cleveland, Ohio 44124 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **PERSSON, Bengt-Goran** [SE/SE]; Sidenvagen 12, S-518 31 Sandared (SE). **VANDERLAAN, Dale** [US/US]; 6901 Bentley Drive, Kalamazoo, Michigan 49009 (US). **KASPER, Lew** [US/US]; 2970 Western Reserve Road, Poland, Ohio 44514 (US).

(74) Agent: **BULSON, Don, W.**; Renner, Otto, Boisselle, & Sklar, LLP, 1621 Euclid Avenue, 19th Floor, Cleveland, Ohio 44115 (US).

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(54) Title: FLOW MANAGEMENT SYSTEM FOR HYDRAULIC WORK MACHINE

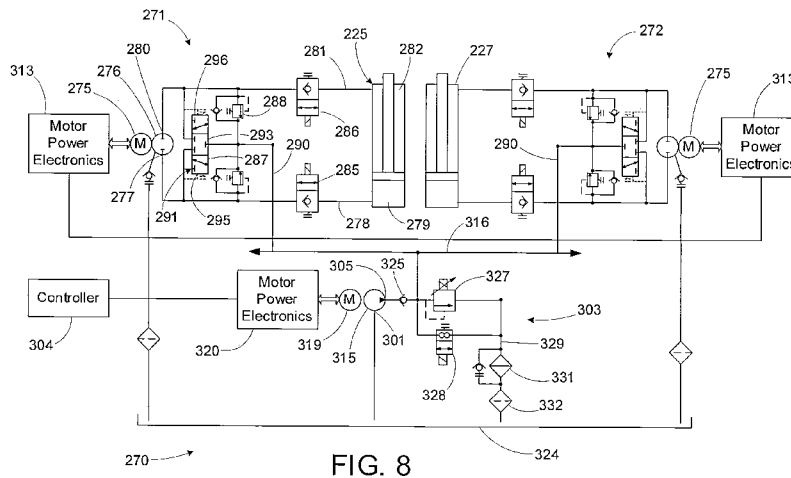


FIG. 8

(57) Abstract: A flow management system (270) capable of providing adjustable hydraulic fluid flow or pressure at a common line to supply bidirectional pumps in electro-hydrostatic actuation systems and conditioning re-circulated hydraulic fluid. The system enables flow sharing between multiple actuation systems (271,272) and minimization of energy consumption by a power-on-demand approach and/or electrical energy regeneration while eliminating the need for an accumulator. The system has particular application to electro-hydrostatic actuation systems that typically include bi-directional electric motor driven pumps (276) and unbalanced hydraulic actuators (225,227) connected within closed circuits to provide work output against external loads and reverse-ly recover energy from externally applied loads.

WO 2009/102740 A3

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/033720

A. CLASSIFICATION OF SUBJECT MATTER
 INV. F15B21/08 F15B7/00 E02F9/22

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)

E02F F15B

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)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2001 002371 A (KOBE STEEL LTD; KOBELCO CONSTR MACHINERY LTD) 9 January 2001 (2001-01-09)	1-3, 15, 16
Y	paragraphs [0051] - [0058], [0061] - [0063], [0067] - [0071]; figures 1, 2	7-13, 18, 19
Y	US 6 962 050 B2 (HIRAKI HIKOSABURO [JP] ET AL) 8 November 2005 (2005-11-08) cited in the application column 9, line 39 - column 10, line 3 column 10, line 66 - column 11, line 9 column 11, lines 32-67; figures 2, 4, 7-17	7-13, 18, 19
A	US 5 144 801 A (SCANDERBEG DINO [US] ET AL) 8 September 1992 (1992-09-08) cited in the application	
	-/--	

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

9 June 2009

Date of mailing of the international search report

02/09/2009

Name and mailing address of the ISA/

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

Authorized officer

Rechenmacher, M

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/033720

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 912 849 B2 (INOUE HIROAKI [JP] ET AL) 5 July 2005 (2005-07-05) cited in the application -----	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/033720

Box No. 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 No. 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 allsearchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

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.:

1-19

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- 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: 1-19

Hydraulic system comprising a double-acting actuator connected to a bi-directional pump driven by an electric bi-directional pump drive, a boost system with a boost pump driven by an electric boost pump drive and a controller including a logic device for controlling operation of the electric bi-directional pump drive and the boost pump drive.

2. claims: 20-35

Hydraulic system comprising a double-acting actuator connected to a bi-directional pump by first and second flow lines, a boost system with a boost pump and a valve assembly connected between first and second flow lines and a third flow line, the valve assembly being operated by differential pressure between the first and second flow lines for supplying make-up fluid through the third fluid flow line or accepting excess fluid from the third fluid flow line.

3. claims: 36-47

Hydraulic system comprising a double-acting actuator connected to a bi-directional pump driven by an electric drive system, a boost system with a boost pump for circulating hydraulic fluid through at least part of the electric drive system for cooling purposes.

4. claims: 48,49

Hydraulic system comprising a double-acting actuator connected to a bi-directional pump driven by an electric drive system, a boost system with a boost pump for circulating hydraulic fluid through a flow restriction for fluid warm-up.

5. claim: 50

Hydraulic system comprising a double-acting actuator connected to a bi-directional pump driven by an electric drive system, a boost system with a boost pump wherein energy of a load acting on the actuator is recovered by the boost pump.

6. claim: 51

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Hydraulic system comprising a double-acting actuator connected to a bi-directional pump driven by an electric drive system, a boost system with a boost pump which is a submersible pump submersed in a reservoir for the fluid.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2009/033720

Patent document cited in search report	A	Publication date	Patent family member(s)	Publication date
JP 2001002371	A	09-01-2001	NONE	
US 6962050	B2	08-11-2005	DE 60126081 T2 EP 1288505 A1 WO 0188381 A1 JP 3862256 B2 US 2003097837 A1	10-01-2008 05-03-2003 22-11-2001 27-12-2006 29-05-2003
US 5144801	A	08-09-1992	AT 111570 T DE 69012403 D1 DE 69012403 T2 EP 0395420 A2 JP 3000304 A JP 3020066 B2	15-09-1994 20-10-1994 16-02-1995 31-10-1990 07-01-1991 15-03-2000
US 6912849	B2	05-07-2005	US 2003188530 A1	09-10-2003