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Declaration under Rule 4.17:

— of inventorship (Rule 4.17(iv))

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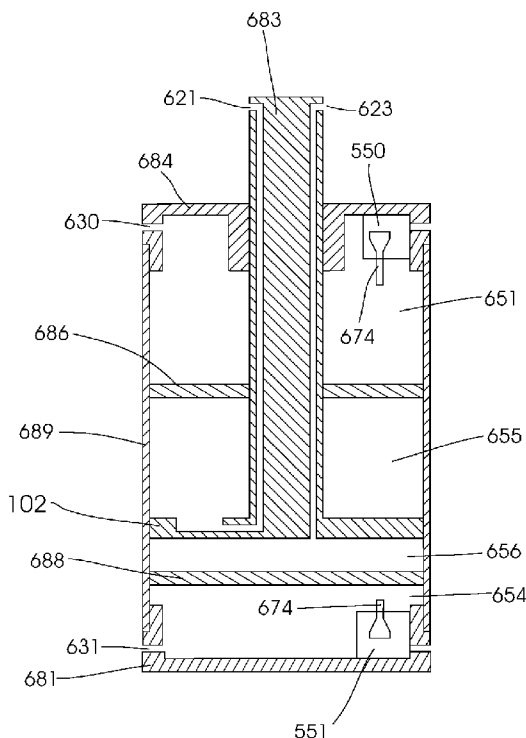
— with international search report

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20 November 2008

(54) Title: FLUID ACTUATOR WITH LIMIT SENSORS AND FLUID LIMIT VALVES

FIG 12a



(57) Abstract: A fluid actuator with fluid limit valves (550,551) and optional adjustable mechanical limits enables the construction of fluid linkages which are able to completely replace mechanical linkages. In a fluid circuit comprising of two or more fluid actuators, the pistons (102) of the fluid actuators can become uncorrelated when fluid leakage occurs. At the piston (102) extension and retraction limits, fluid limit valves (550,551) open. The open fluid limit valves (550,551) allow fluid to bypass pistons (102) and/or allow fluid from an external source to compensate the fluid leakage. The fluid bypassing pistons (102) at their extension or retraction limit and/or externally supplied fluid forces the uncorrelated pistons (102) to reach their extension or retraction limit as well. The fluid actuator with optional adjustable mechanical limits have one or more additional pistons (686,688), which have an adjustable separation from the main piston (102) or end of cylinder. The fluid actuator with fluid limit valves (550,551) and optional adjustable mechanical limits enables mechanical linkages to be replaced by fluid circuits composed of the fluid actuators.

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INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER
 IPC: *F15B 15/24* (2006.01) , *B62D 5/09* (2006.01) , *F15B 13/02* (2006.01)
 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)
 IPC: F15B, B62D
 U.S. Cl.: 92, 60, 137

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

Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used)
 Google, QPat (FamPat), keywords: hydraulic? or pneumatic? or fluid?, fluid switch+ or switch valve? or limit switch+ or limit sensor?, bypass or by-pass, piston? or cylinder?

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3941033 A (OLSEN, C.) 2 March 1976 (02-03-1976) * Cited by Applicant * * Fig. 2; col. 3 and 4 *	1, 10
A	GB 944366 A (HUTTER, J. et al.) 11 December 1963 (11-12-1963) * Whole document *	1-7, 10-14, 17 and 18
A	US3920217 A (OLSEN, C.) 18 November 1975 (18-11-1975) * Cited by Applicant * * Whole document *	1-7, 10-14, 17 and 18
A	US 4165674 A (WEIGT, A.) 28 August 1979 (28-08-1979) * Cited by Applicant * * Whole document *	1-7, 10-14, 17 and 18
A	US 7028469 B2 (PORSKROG, B. et al.) 18 April 2006 (18-04-2006) * Cited by Applicant * * Whole document *	8, 9, 15 and 16

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 application or patent 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
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Date of the actual completion of the international search 10 July 2008 (10-07-2008)	Date of mailing of the international search report 28 August 2008 (28-08-2008)
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Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476	Authorized officer Maciek Kepka 819- 934-9121
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INTERNATIONAL SEARCH REPORT

International application No.
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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of the 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. Claim Nos. :
because they relate to subject matter not required to be searched by this Authority, namely :

2. Claim Nos. : 3, 4, 5, 11- 14
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 :

The subject matter of these claims is rendered ambiguous by: expressions such as "optional" (claims 3, 5, 12, 14) , "a said piston" (claims 4, 13) or "adjustable said main piston" (claim 11); lack of conciseness; poorly defined relationship between functional elements.

3. Claim Nos. : 6, 7, 17 and 18
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 :

The claims are directed to a plurality of inventive concepts as follows:

Group A - Claims 1-7, 10-14, 17 and 18 are directed to a fluid actuator cylinder and piston and corresponding method comprising limit valves and sensors and additional movable pistons inside said cylinder.

Group B - Claims 8, 9, 15 and 16 are directed to a fluid actuator cylinder and piston and corresponding method comprising limit bypass fluid outlets..

The claims must be limited to one inventive concept as set out in Rule 13 of the PCT.

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 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 claim 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 claim Nos. :

- 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.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2008/050137

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