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(71) Applicant (for all designated States except US): **ISRAEL AEROSPACE INDUSTRIES LTD.** [IL/IL]; Ben Gurion International Airport, 70100 Lod (IL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **PERRY, Arie** [IL/IL]; 3 Shabtai Street, 45257 Hod Hasharon (IL).
BRAIER, Ran [IL/IL]; 8c Emek Haaylon Blvd., P.O. Box 2264, Shoham 73142 (IL).

(74) Agent: **REINHOLD COHN & PARTNERS**; P.O.B 13239, 61131 Tel Aviv (IL).

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Declarations under Rule 4.17:

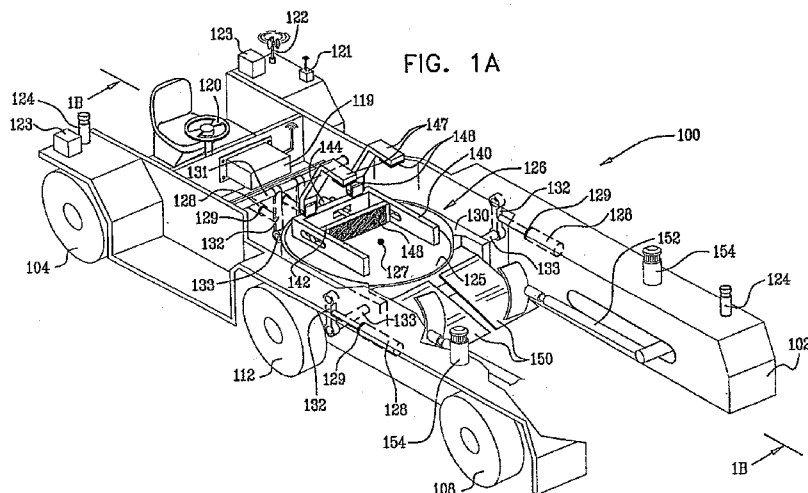
— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

[Continued on next page]

(54) Title: TOWBARLESS AIRPLANE TUG



(57) Abstract: A towbarless airplane tug configured for receiving a landing gear of an airplane and towing it thereby is provided. The tug comprises a chassis configured for receiving thereon at least a portion of the landing gear, a propulsion arrangement configured to move the tug in a direction along a trajectory, at least one force sensor configured to measure, directly or indirectly, a force exerted by the chassis on the landing gear in at least the direction due to a speed differential between the tug and the airplane, and a controller in communication with the force sensor and being configured to alter one or more parameters of movement of the tug such that the force exerted by the chassis on the landing gear is maintained below a predetermined value. The propulsion arrangement comprises a variable angle swash plate hydraulic pump coupled to a variable angle swash plate hydraulic motor and to a controllable bypass path valve, configured such that a hydraulic fluid circulates between the pump and the motor so as to activate the propulsion arrangement to increase at least one of the speed and the traction force of the tug when the bypass path is in a closed state, and at least most of the hydraulic fluid circulates across the motor via the bypass path valve so as to reduce at least one of a rotational speed and traction force of the tug when the bypass path is in an opened state. The controller alters the parameters by regulating at least the power available to the propulsion arrangement, the pump and motor swash-plates, and the state of the bypass path valve.



— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:
16 December 2010

INTERNATIONAL SEARCH REPORT

International application No
PCT/IL2009/001110

A. CLASSIFICATION OF SUBJECT MATTER

INV. B64F1/22

ADD.

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)

B64F 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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 048 625 A (BIRKEHOLM MOGENS [DK]) 17 September 1991 (1991-09-17) * abstract figures 1-3 column 1, line 37 - column 2, line 7 column 2, lines 32-48 column 2, line 61 - column 4, line 39 claim 4	1-25, 29, 30, 32
A	US 5 219 033 A (POLLNER JUERGEN [DE] ET AL) 15 June 1993 (1993-06-15) * abstract figures 1-2c column 4, lines 36-39 ----- -/--	1-25



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

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- *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

15 October 2010

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26/10/2010

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

Cesaro, Ennio

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International application No

PCT/IL2009/001110

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	DE 43 24 211 A1 (LINDE AG [DE]) 26 January 1995 (1995-01-26) column 2, lines 3-65 column 4, line 26 - column 5, line 7 column 6, lines 8-19 figures 1,7 -----	1-25
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A	WO 90/11932 A1 (TANA JYRAE KY [FI]) 18 October 1990 (1990-10-18) * abstract figure 5 -----	1-25
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A	EP 1 574 430 A1 (FMC TECHNOLOGIES [US]) 14 September 2005 (2005-09-14) figure 1 -----	1
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2009/001110

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 all searchable 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.:

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: 1-25

a towbarless airplane tug comprising a controller configured to control the force exerted on the landing gear of the towed aircraft, and method;

2. claims: 26-48

a towbarless airplane tug comprising a controller configured to control the speed of the tug, and method

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IL2009/001110

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