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(54) Title: HEAT ENGINE/ HEAT PUMP USING CENTRIFUGAL FANS

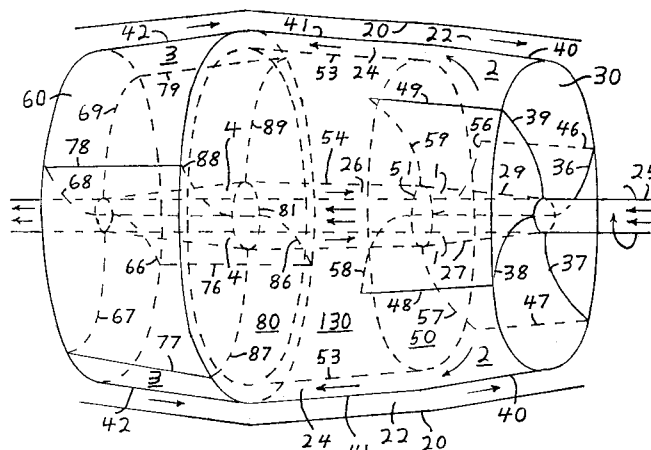


FIG. 1

(57) Abstract: An engine/heat pump is shown. Most of its parts rotate around the same central axis. It comprises two doubly connected chambers. Blades in each chamber substantially rotate with the chamber and may be firmly attached to the walls of the chamber, thus forming a modified centrifugal pump with axial input and discharge. An expandable fluid is rotated outward by one of the pumps and then heat is added for an engine or removed for a heat pump as the fluid is being sent to the outer part of the second pump. The fluid travels toward the center of the second pump, thus impelling the pump in the rotation direction. Then heat is removed for an engine or added for a heat pump as the fluid leaves the second pump and travels back to the first pump near the center of rotation. Rotation energy of the fluid is typically much larger than the circulation energy. A modified centrifugal pump with axial discharge having a casing rotating with the blades is also claimed.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/002910

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F02G 1/04 (2009.01)

USPC - 60/517

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(8) - F02G 1/04, 1/043 (2009.01)

USPC - 60/516, 517, 519, 643, 645, 670, 671

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 practicable, search terms used)

USPTO EAST System (USPGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT), PatBase

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/0075752 A1 (SILVER et al) 13 April 2006 (13.04.2006) entire document	1, 3-5
-		-----
Y		6, 8-10
Y	US 2006/0090467 A1 (CROW) 04 May 2006 (04.05.2006) entire document	6, 8-10
A	US 7,320,218 B2 (SILVER et al) 22 January 2008 (22.01.2008) entire document	1-10
A	US 2007/0068712 A1 (CARNAHAN) 29 March 2007 (29.03.2007) entire document	1-10
A	US 4,009,573 A (SATZ) 01 March 1977 (01.03.1977) entire document	1-10

 Further documents are listed in the continuation of Box C.

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

17 August 2009

Date of mailing of the international search report

**01 SEP 2009**

Name and mailing address of the ISA/US

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/002910

**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:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-10 are drawn to a device comprising a first substantially centrifugal compressor and a second substantially centrifugal compressor.

Group II, claims 11-12 is drawn to a pump.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical features of Group I, a first fluid connection, a first substantially centrifugal compressor, a second fluid connection, a second substantially centrifugal compressor, means to add heat, means to remove heat, are not present in Group II; the special technical features of Group II, a set of blades, a casing, the velocity vector of each point within the blades, are not present in Group I.

Since none of the special technical features of the Group I-II inventions is found in more than one of the inventions, unity is lacking.

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 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.:  
1-10

- 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.