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- 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.

(54) Title: SHAPED CORE CAVITATION NUCLEAR REACTOR

(57) Abstract: A method and apparatus for driving nuclear reactions in a controlled manner within a shaped cavitation nuclear reactor or CNR is provided. The shape of the CNR is generally cylindrical, with the central region of the reactor having a substantially smaller diameter than either end portion. Due to this shape, the central reactor region undergoes enhanced cavitation with numerous reaction sites being in close proximity to the surface of the reactor's central region. As a result, the shaped reactor configuration is well suited for use as a photon/particle source. Attached to either end of the CNR is a driver assembly, the driver assemblies being used to couple acoustic energy into the reactor. The CNR may be contained within a high pressure enclosure fabricated from a material capable of withstanding the high reactor operating temperatures. Preferably the high pressure enclosure is encased in one or more layers of thermal insulation, followed by an outer enclosure. Coolant, fed through one or more nozzles, impinge upon the outer surface of the reactor thereby providing reactor cooling as well as a means of generating a high pressure fluid such as vapor or steam. The high pressure fluid is, in turn, coupled to an energy conversion system such as a steam turbine, heater radiator, steam piston motor, or other heat exchanger. The reactor system may include one or more static stress amplitude modulators which provide a means of simultaneously applying a static force with the dynamic forces applied by the drivers.



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A. CLASSIFICATION OF SUBJECT MATTER
 IPC(7) : G21B 01/00, 01/02
 US CL : 367/157 & 160-162; and 376/100-103, 146 & 149
 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)
 U.S. : 367/157 & 160-162; and 376/100-103, 146 & 149

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)
 Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y, P	US 6,024,935 A (MILLS et al) 15 February 2000 (15.02.2000), see entire document. Particularly note Figure 5 and columns 26+.	1-7
Y	US 5,982,801 A (DEAK) 09 November 1999 (09.11.1999), see column 10.	1-7
Y	US 5,968,323 A (PLESS) 19 October 1999 (19.10.1999), see entire document.	1-7
Y	US 5,659,173 A (PUTTERMAN et al) 19 August 1997 (19.08.1997), see entire document.	1-7
Y	US 5,525,041 A (DEAK) 11 June 1996 (11.06.1996), see entire document.	1-7
Y	US 5,411,654 A (AHERN et al) 02 May 1995 (02.05.1995), see entire document.	1-7
Y	US 4,874,596 A (LEMELSON) 17 October 1989 (17.10.1989), see entire document.	1-7
Y	US 4,448,743 A (BASS) 15 May 1984 (15.05.1984), see entire document.	1-7
Y	US 4,968,395 A (PAVELLE et al) 06 November 1990 (06.11.1990), see entire document.	1-7

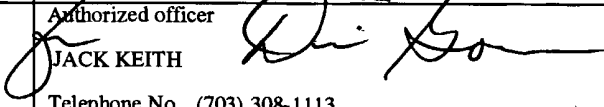
Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"B" earlier application or patent 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		

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Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international 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.:
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. Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation 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.: 1-7

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.
 No protest accompanied the payment of additional search fees.

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C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,367,130 A (LEMELSON) 04 January 1983 (04.01.1983), see entire document.	1-7
Y	US 4,344,911 A (MANISCALCO et al) 17 August 1982 (17.08.1982), see entire document.	1-7
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Y	JP 03-067196 A (FUJIMURA) 22 March 1991 (22.03.1991), see Abstract.	1-7
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Y	DE 4,008,040 A1 (WERTZ) 31 October 1990 (31.10.1990), see Abstract.	1-7
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Y	WO 97/49274 A2 (LO) 31 December 1997 (31.12.1997), see entire document.	1-7
Y	WO 96/21230 A1 (EMBRECHTS et al) 11 July 1996 (11.07.1996), see entire document.	1-7
A	BROWNE, M.W. New Shot at Cold Fusion By Pumping Sound Waves Into Tiny Bubbles The New York Times - Science Times. 20 December 1994, C1 and C10.	1-7
A	FOLEY, D. Star in a Jar Popular Science. December 1998, pages 88-91	1-7
A	BARBER et al. Sensitivity of Sonoluminescence to Experimental Parameters Physical Review Letters. 28 February 1994, pages 1380-1383.	1-7
A	MOSS et al. Calculated Pulse Widths and Spectra of a Single Sonoluminescing Bubble Science. 30 May 1997, Vol. 276, pages 1398-1401.	1-7
A	CRUM, L.A. Sonoluminescence Physics Today. September 1994, Pages 22-29.	1-7
A	BARBER et al. Observation of synchronous picosecond sonoluminescence Nature. 25 July 1991, Vol. 352, No. 6333, pages 318-320.	1-7

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C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	MOSS et al. Sonoluminescence and the prospects for table-top micro-thermonuclear fusion Physics Letters A. 16 November 1995, pages 69-74.	1-7
A	GAITAN et al. Sonoluminescence and bubble dynamics for a single, stable, cavitation bubble Journal of the Acoustical Society of America. June 1993, Vol. 91, No. 6, pages 3166- 3183.	1-7
A	PREVENSLIK, T.V. Sonoluminescence, Cold Fusion, and Blue Water Lasers Cold Fusion Source Book - Proceedings of the International Symposium on Cold Fusion and Advanced Energy Sources. 24-26 May 1994, pages 1-4.	1-7
A	DINGEE, D.A. Fusion Power C&EN. 02 April 1979, Vol. 1, No. 2, Pages 32-47.	1-7
A	WILSON, J. Hot Sounds WWW.Popular Mechanics.com. Accessed: 7/13/2001 Article date: February 1998, Pages 1-3.	1-7
Y	US 3,378,446 A (WHITTLESEY) 16 April 1968 (16.04.1968), see entire document.	1-7
Y	US 3,346,458 A (SCHMIDT) 10 October 1967 (10.10.1967), see entire document.	1-7
Y	US 3,037,922 A (JOHNSON) 05 June 1962 (05.06.1962), see entire document.	1-7
Y	US 5,658,534 A (DESBOROUGH et al) 19 August 1997 (19.08.1997), see entire document.	1-7
X	US 5,030,873 A (OWEN) 09 July 1991 (09.07.1991), see entire document.	1-5
X	US 3,558,936 A (HORAN) 26 January 1971 (26.01.1971), see entire document.	1-5
Y	US 4,395,908 A (SHOPLAND) 02 August 1983 (02.08.1983), see entire document.	1-7
Y	US 4,894,811 A (PORZIO) 16 January 1990 (16.01.1990), see entire document.	6-7
Y	US 5,875,154 A (DECHICO) 23 February 1999 (23.02.1999), see entire document.	1-7
A	FUKUSHIMA, Is Sono-Fusion to be a Possible Mechanism for Cold Fusion? Fontiers of cold Fusion. 1993, Pages 609-612.	1-7
A	MARGULIS, M.A. Modern Views on the Nature of Acousto-chemical Reactions, Russian Journal of Physical Chemistry. January 1976, pages 1-11.	1-7

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Continuation of Item 4 of the first sheet:

Title is too long.

New title: Shaped Core Cavitation Nuclear Reactor *W*

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for more than one species to be examined, the appropriate additional examination fees must be paid. The species are as follows:

- Invention I - drawn to claims 1 and 6-7.
- Invention II - drawn to claims 1 and 8.
- Invention III - drawn to claims 1 and 9.
- Invention IV - drawn to claims 1 and 10.
- Invention V - drawn to claims 1 and 11.
- Invention VI - drawn to claims 1 and 12.
- Invention VII - drawn to claims 1 and 13-15.
- Invention VIII - drawn to claims 1 and 16-19.
- Invention IX - drawn to claims 1 and 20-25.
- Invention X - drawn to claims 1 and 26-29.
- Invention XI - drawn to claims 1 and 30 .

Upon election of invention VIII only, the applicant is further required to elect:

- A. Embodiment wherein the high pressure fluid is a liquid (drawn to claim 18).
- B. Embodiment wherein the high pressure fluid is a vapor (drawn to claim 19).

Upon election of Invention IX only, the applicant is further required to elect:

- C. Embodiment wherein the host material melting temperature is greater than the melting temperature associated with the fuel material (drawn to claim 22).
- D. Embodiment wherein the host material melting temperature is greater than the vaporization temperature of the fuel material (drawn to claim 23).
- E. The host and fuel material of the reactor:

Host material drawn to claim 24:

- Ea. titanium
- Eb. tungsten
- Ec. gadolinium
- Ed. cadmium
- Ee. molybdenum
- Ef. rhenium
- Eg. osmium
- Eh. hafnium
- Ei. iridium
- Ej. niobium
- Ek. ruthenium
- El. tantalum

Fuel material drawn to claim 25:

- Em. deuterium
- En. tritium
- Eo. lithium

Upon election of invention X only, the applicant is further required to elect:

- F. Embodiment wherein the static stress amplitude modulator applies a static compressive force to the reactor (drawn to claim 27).

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G. Embodiment wherein the static stress amplitude modulator applies a tensile force to the reactor (drawn to claim 28).

The following claims appear to be generic: Claims 1-5

This International Searching Authority considers that the international application does not comply with the requirements of unity of invention (Rules 13.1, 13.2 and 13.3) for the reasons indicated below:

The species listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: There is no common special technical feature which defines a contribution over the prior art.

Continuation of B. FIELDS SEARCHED Item 3:

East

search terms: Sono (luminescence, fusion, cavitation), bubble