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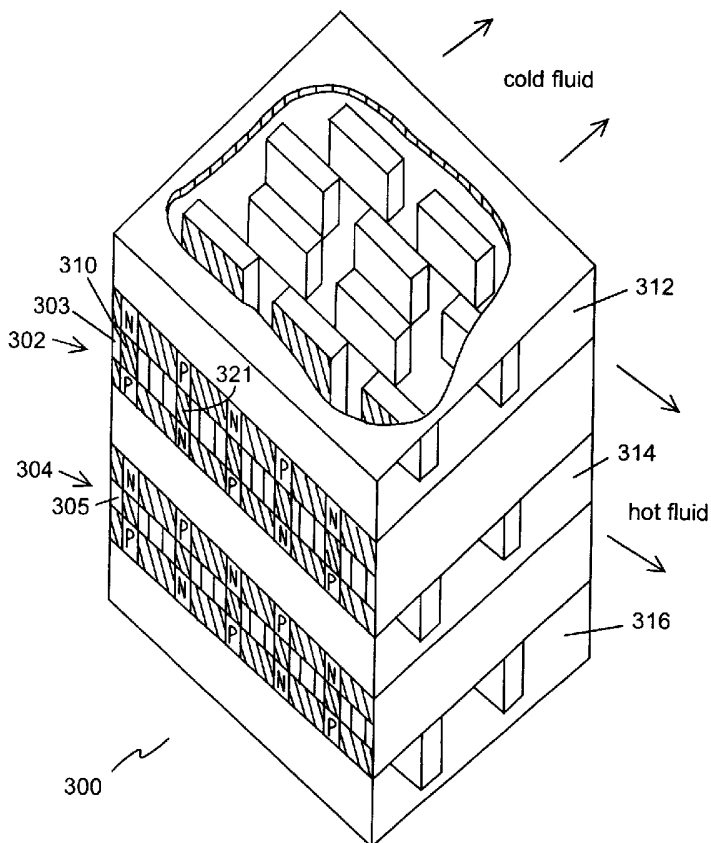
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[Continued on next page]

(54) Title: THERMOELECTRIC MODULE WITH INTEGRATED HEAT EXCHANGER AND METHOD OF USE



(57) Abstract: The electrical junctions of either or both sides of a thermoelectric module are placed in direct thermal contact with a heat source or sink or a material to be thermally modified (that is, heated or cooled), thereby eliminating the conventional substrate typically found in such modules and its associated thermal resistance. In one embodiment, the conductive junction passes through a conduit carrying a material to be heated or cooled. In the conduit, the conductive material can be configured into an effective heat transfer shape such as a vane which extends through non-conducting conduit walls. In another embodiment, the geometry of the conductor forming the electrical junction forms a pipe or tube through which material to be heated or cooled is passed. A protection layer of high thermal conductivity can be applied to the conductive surfaces in order to prevent corrosion or short-circuiting of the device in applications where an electrolytic or ionic fluid is passed by the junction.

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INTERNATIONAL SEARCH REPORT

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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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)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 924 481 A (SEL APPLIC CO LTD ;MORIX CO LTD (JP)) 23 June 1999 (1999-06-23) paragraph '0020! - paragraph '0028!; figures 1,2	1,2,5, 7-10,13, 16,17,20
X	US 4 055 053 A (ELFVING DECEASED THORE M ET AL) 25 October 1977 (1977-10-25) column 6, line 6 -column 8, line 22; figures 7,9-11	1-3,5,8, 9,11,13, 16-18
X	US 2 997 514 A (ROEDER JR JOHN) 22 August 1961 (1961-08-22) figure 1	1-3,5,8, 9,11,13, 16-18

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Patent family members are listed in annex.

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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0924481	A	23-06-1999	JP 11023091 A EP 0924481 A1 US 6226994 B1 WO 9901703 A1
US 4055053	A	25-10-1977	IT 1064830 B
US 2997514	A	22-08-1961	NONE