

U.S. Patent Documents regarding Ultrasonic Transducers:

[0006]

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Brief Description of Drawings:

[0007]

Fig. 1 is a generic outside view of the invention presenting a complex tube resonator.

Fig. 2 is an assembly view of the main internal and external parts of the invention presented on fig. 1.

Fig. 3 is a generic cross section view of the invention presented on Figs. 1 and 2.

Description of Preferred Embodiments:

[0008] Please refer to Fig. 1 which relates to a generic external view of the invention in its embodiment, presenting a multi-frequency resonating mode, complex tube resonator 1, made of a tube or a hollow or solid elongated strip made of a long bar of metal 2, consisting of internally, or externally inserted and fixed transducers array 12, of multiple transducer elements 13, in other words, fixed to the internal or external tube surface, presenting electrically in-parallel-connected Langevin transducer elements 13, watertight sealed and closed on both tube ends with metal caps 4 in case of internal transducer array assembling, and ending with flange detail 3 and cable conduit 11, delivering strong vibrations and multi frequency oscillations on the tube resonator external surface 1, while driven by electric signal power supply, activating the complex resonance field of multiple frequencies of the tube resonator 1, to achieve wide-band sonic and ultrasonic waves radiation on the whole external surface towards external fluid, while the same effects can be realized when transducer array is fixed externally radiating towards internal tube space, when the same concept is not limited to only to installing one transducer array.

[0009] After the above-described structure is assembled, it presents the complex resonator 1 module for generating multiple and wide band frequency resonance and radiation of sonic and ultrasonic waves, with its internal elements, components and parts presented on Fig. 2, and Fig 3. Meanwhile, the transducer array 12 is directly and axially fixed to the internal surface of the tube 2 of the resonator 1, to directly produce vibrations, invoking various sonic and ultrasonic frequency wavelengths, exciting various vibration modes, and activating the resonator 1 in order to transmit vibrations outward in the fluid, where the resonator 1 is immersed, and the same effects can be realized when transducer array 12 is fixed to the external tube surface radiating a fluid in internal tube space.

[0010] With the described structural design of the invention (Figs. 1, 2 and 3), the operating coordination of electrical energy converter and operating frequency and the length of the resonator will no longer be an important operating factor. There is no need for balanced integer number of half wavelengths, corresponding to precise wavelengths,

Fig. 1

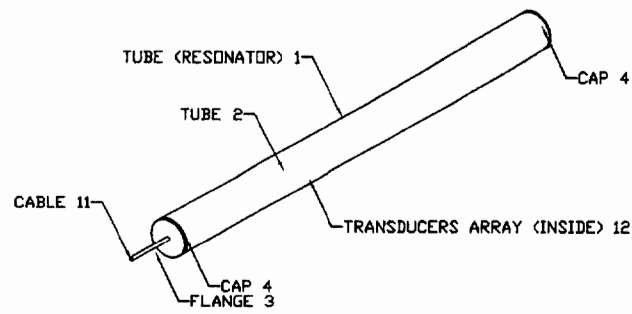


Fig. 2

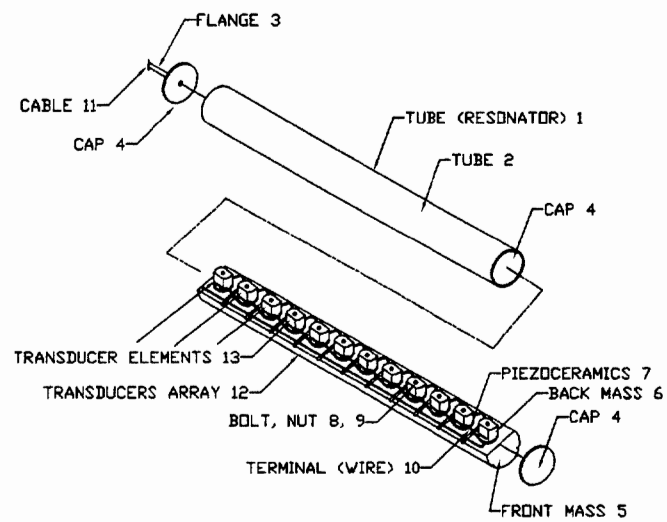
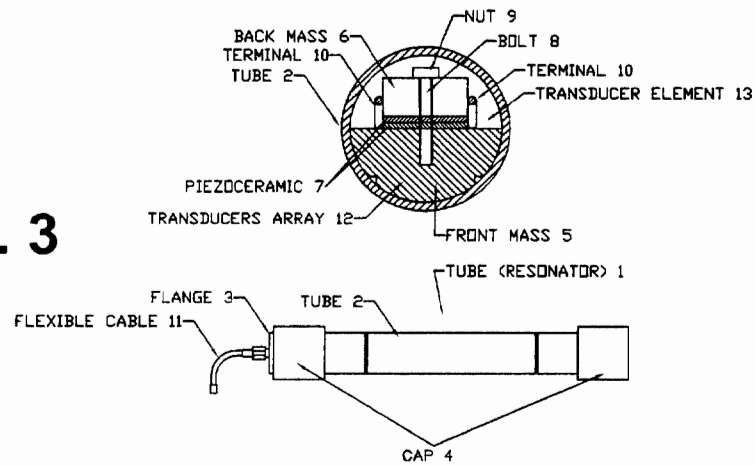


Fig. 3





European Patent
Office

PARTIAL EUROPEAN SEARCH REPORT

Application Number

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

EP 02 40 5863

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	US 3 496 533 A (SEMELINK ADELBERT) 17 February 1970 (1970-02-17) * column 4, line 46 - column 5, line 26 * ---	1,5	B06B1/06
Y	DE 197 24 189 A (BANDELIN ELECTRONIC GMBH & CO) 3 December 1998 (1998-12-03) * column 1, line 24 - line 43 * * column 2, line 62 - column 3, line 42 * ---	1,5	
A	US 5 450 373 A (KUPISZEWSKI THOMAS ET AL) 12 September 1995 (1995-09-12) * column 3, line 37 - line 55 * ---	1,2	
A	US 3 731 267 A (BRANDT O ET AL) 1 May 1973 (1973-05-01) * column 1, line 30 - line 60 * ---	2	
A	US 3 139 603 A (CHURCH DONALD R ET AL) 30 June 1964 (1964-06-30) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B06B G10K
INCOMPLETE SEARCH			
<p>The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims.</p> <p>Claims searched completely</p> <p>Claims searched incompletely</p> <p>Claims not searched</p> <p>Reason for the limitation of the search:</p> <p>see sheet C</p>			
Place of search		Date of completion of the search	Examiner
THE HAGUE		14 February 2003	Swartjes, H
CATEGORY OF CITED DOCUMENTS		<p>T : theory or principle underlying the invention</p> <p>E : earlier patent document but published on, or after the filing date</p> <p>D : document cited in the application</p> <p>L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>	
<p>X : particularly relevant if taken alone</p> <p>Y : particularly relevant if combined with another document of the same category</p> <p>A : technological background</p> <p>O : non-written disclosure</p> <p>P : intermediate document</p>			

EP-0 FORM 1503 03 B2 (PDA/C07)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 40 5863

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-02-2003

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EPO FORM P4269

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82