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(54) FLOW CELL HORN AND METHOD OF TUNING

(57) An ultrasonic horn includes a generally cylindrical input section having an energy input end, a generally cylindrical output section having an energy output end, and a throat section disposed between the input section and the output section, the throat section being defined by a side wall having a continuous curve and having a diameter tapering down from a diameter generally equal to a diameter of the input section on a side connected to the input section, and tapering down from a diameter generally equal to a diameter of the output section on a side connected to the output section, to a minimum throat diameter. The minimum throat diameter is smaller than the diameter of the output section and the diameter of the output section is smaller than the diameter of the input section. The side wall of the throat section has a constant radius of curvature.

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EUROPEAN SEARCH REPORT

Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CA 2 393 607 A1 (MISONIX INC [US]) 28 June 2001 (2001-06-28) * abstract; claim 1; figures 2,4 * * page 9, lines 10-17 * * page 11, lines 6-8,12,13 * * page 12, lines 16-18 *	1-14	INV. B06B3/00 B01F31/80 B05B17/06
A	US 5 386 169 A (DUBRUQUE DOMINIQUE [FR]) 31 January 1995 (1995-01-31) * abstract; claim 1; figure 1 *	1-14	
A	Emerson Industrial Automation: "Horn Catalog Ultrasonic Horn Catalog 2 Contents", , 26 September 2019 (2019-09-26), pages 1-28, XP055903147, Retrieved from the Internet: URL:https://www.emerson.com/documents/automation/catalog-ultrasonic-horn-branson-en-us-160126.pdf [retrieved on 2022-03-18] * Figures of spool shaped horns; pages 1,16 *	1-14	TECHNICAL FIELDS SEARCHED (IPC) B06B B01F B65D B05B
A	WO 2008/080888 A1 (SODEVA [FR]; BOURSIER GILLES [FR]; VAXELAIRE PHILIPPE [FR]) 10 July 2008 (2008-07-10) * abstract; claims 1,15; figures 2a,2b * * page 15, line 29 - page 16, line 15 *	1-14	

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	16 June 2023	Fernandes, Paulo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

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☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-14

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-14

An ultrasonic horn comprising generally cylindrical input and output sections and a throat section between the input and output sections and defined by a side wall having a continuous curve wherein the diameter of the throat tapers down from the input and output sections, the minimum diameter of the throat is smaller than the diameter of the output section which is smaller than the diameter of the input section and wherein the side wall of the throat section has a constant radius of curvature.

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2. claim: 15

An ultrasonic horn comprising generally cylindrical input and output sections and a throat section between the input and output sections and defined by a side wall having a continuous curve wherein the frequency of the horn is analyzed and the horn is tuned by milling in a particular way.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 15 3837

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
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16-06-2023

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