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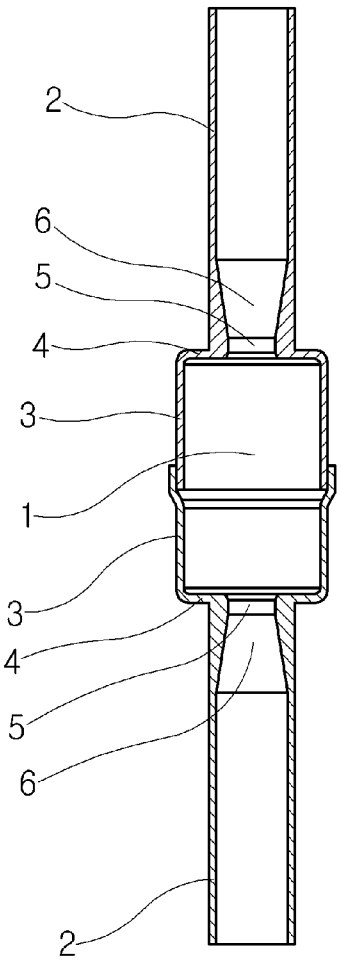
(54) Title: ABSORBING DEVICE AND METHOD FOR ITS PRODUCTION



(57) Abstract: The absorbing device comprises a hollow enclosed chamber (1) that consists of two pot parts (3) connectable to each other with their open ends by welding or soldering, wherein the bottom (4) of each of the pot parts (3) is an integral constituent of respective one of the two ends of the air-conditioning conduit (2) oriented toward each other and is provided with a reduced passage opening (5) interconnected with the internal space of the respective part of the air-conditioning conduit (2). Fig. 1

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Description

Title of Invention: ABSORBING DEVICE AND METHOD FOR ITS PRODUCTION

Technical Field

[1] Presently known and used absorbing devices for the reduction of pressure pulses caused by a compressor in an air-conditioning conduit of an air-conditioning system consist of a hollow enclosed body having mostly a cylinder shape, which is integrated between two ends of the air-conditioning conduit oriented toward each other.

Background Art

[2] The absorbing measure of such device is given by so called expansion rate. The expansion rate is defined as a ratio of the chamber internal diameter to the internal diameter of the inlet and/or outlet ducts.

[3] An exemplary embodiment of the absorbing device can be found in the US Patent No. 4,122,914, wherein an inlet tube leads into an internal space of the absorbing element, while a respective end of the inlet tube is tapered in the shape of an elongated nozzle and perforations are made before the tapered elongation. An outlet tube extends into the space of the absorbing element in such manner that parts of both tubes are parallel and are supported by partitions.

[4] Another exemplary embodiment presents a construction design of an absorbing device described in the document JP 1986-184808 that presents a simpler construction solution, wherein both inlet and outlet ducts lead into a chamber internal space, while an internal diameter of said inlet and outlet ducts in the absorbing chamber is first reduced and then enlarged.

Disclosure of Invention

Technical Problem

[5] A disadvantage of this construction design is, on one hand, a more complicated internal arrangement of the absorbing element and, on the other hand, a necessity of an expensive fabrication of another separate part of the air-conditioning system.

Solution to Problem

[6] The above mentioned disadvantages are eliminated with a provision of an absorbing device according to the presented invention, that comprises a hollow, enclosed chamber integrated through its inlet and outlet ends between two ends of the air-conditioning conduit oriented toward each other, the substance of which is characterised by the fact that the hollow, enclosed chamber consists of two pot parts connectable to each other with their open ends, while each of the pot parts is an integral constituent of a respective one of the two air-conditioning conduit ends oriented

toward each other and is provided with a reduced passage opening interconnected with the internal space of said part of the air-conditioning conduit, respectively.

[7] The substance of this construction solution of the absorbing device is also characterised by the fact that the reduced passage opening is interconnected with the internal space of the respective part of the air-conditioning conduit through a progressively widening transitional section, while both pot parts are mutually connected to each other with their open ends by welding or soldering. In this way the expansion rate, as well as a performance of the absorbing element are being kept at concurrent reduction of both internal and external diameters of the absorbing element.

[8] In case of a high absorbing performance requirement it is also possible to use an absorbing device according to the second variant of the invention that comprises a hollow, enclosed chamber integrated through its inlet and outlet ends between two adjacent ends of the air-conditioning conduit, the substance of which is characterised by the fact that each of the ends of the air-conditioning conduit is provided, for the purpose of its securing in the inlet or outlet openings in the hollow enclosed chamber, with a coaxial mouthpiece, the diameter of which is smaller than the internal diameter of the ends of the air-conditioning conduit. In this way the expansion rate is increased, while the same internal diameter of the absorbing element is still retained. As a result its performance increases substantially.

[9] As essential for the absorbing device according to the first variant it is therefore necessary to consider a method for its production, as well. At each of the ends of the air-conditioning conduit a reduction of the internal diameter of the tube is performed by ramming and the thickness of the wall of said tube also increases to provide a sufficient amount of material for subsequent forming operations, in which the end of the tube is widened subsequently in several steps up to its final diameter and at the same time a calibrating of the shape of pot parts, as well as a reducing of the internal diameter of the tube are performed, where in the case of a pot part having a peripheral edge flange also, in another step, a peripherally fitted flange for the connection with the adjacent part of the absorbing element is formed by welding or soldering.

Advantageous Effects of Invention

[10] An advantage of this construction according to the first variant of the invention is especially based on the fact that the absorber body generally has a smaller diameter due to the proposed reduction of the diameter of the inlet and outlet parts of the air-conditioning conduit. By reduction of diameters of the mouthpiece and absorbing device at keeping the same expansion rate the original efficiency is achieved. Moreover, the optimized geometry of the inlet/outlet reduction of the mouthpiece does not increase the loss of pressure of this component considerably; thereby it does not

decrease the total efficiency of the air-conditioning system significantly.

Brief Description of Drawings

[11] Examples of embodiments of the absorbing device according to the invention for reducing pressure pulses caused by a compressor in an air-conditioning conduit of an air-conditioning system are illustrated in accompanying drawings, in which:

[12] Fig. 1 is a longitudinal, axial cross-sectional view of the first construction variant of the absorbing device;

[13] Fig. 2 is a longitudinal, axial cross-sectional view of the second construction variant of the absorbing device;

[14] Fig. 3 shows a process of production of one half of the absorbing device of Fig. 1 according to production steps; and

[15] Fig. 4 is a longitudinal, axial cross-sectional view of a variant with inserted, widened section as a separate element.

Best Mode for Carrying out the Invention

[16] As it can be seen in the Fig. 1 the absorbing device consist of a hollow, enclosed chamber 1, which comprises two pot parts 3 connectable to each other their open ends, each of said pot parts 3 is an integrated component of one of two ends of the air-conditioning conduit 2 oriented toward each other and is provided with a passage 5 interconnected via the gradually widening section 6 with the internal space of the respective part of the air-conditioning conduit 2. From the above it is obvious, as can be seen in Fig. 4, that the internal diameter D2 of the air-conditioning conduit is larger than the diameter D5 of the passage 5 at the outlet of the air-conditioning conduit leading into the pot part 3.

[17] Both pot parts 3 are mutually attached to each other via their open ends by welding or soldering.

[18] At each end of the air-conditioning conduit a reduction of the internal diameter of the tube is performed by ramming and the thickness of the wall of said tube is also increased to provide a sufficient amount of material for subsequent forming operations, while the original outer diameter of the tube is still retained. During further operations the end of the tube is gradually widened up to its final diameter in several steps. In parallel with these operations a calibrating of the shape of the pot parts, as well as the narrowing of the tube internal diameter are performed. For a pot part having a peripheral edge flange, in another step a peripherally fitted flange for the connection with the adjacent part of the absorbing element is also formed by welding or soldering.

[19] Apart from the arrangement, where the widening section 6 is formed as an integral constituent of the air-conditioning conduit 2, an additional variant is possible, wherein the gradually widening section 6 is formed as a separate part and is secured at the

outlet of the air-conditioning conduit 2 leading into the pot part 3, as can be seen in Fig. 4.

[20] Typically, during the technological process (as can be seen in the Fig. 3) for obtaining the reduction of the inlet and expansion chamber diameters the following steps are performed: In the first step, a required section having a required length at each of ends of the cut away tube is being formed by ramming to reduce the internal diameter and increase the thickness of its wall to provide a sufficient amount of material for subsequent forming operations, while the original outer diameter of the tube is still retained.

[21] Further, in the second step, the tube end is being enlarged up to its final diameter, while the calibrating of the widening of the internal tube diameter is being performed at the same time. Then the end of the tube is being widened until the final diameter is accomplished with the use of a stamping tool. In the next step the calibration of this final diameter is being performed to obtain desired pot parts 3 of the absorbing device.

[22] For a pot part 3 having a peripheral edge flange, the periphery of this pot part 3 is additionally provided with a peripherally fitted flange.

[23] As can be seen in the Fig. 2, the absorbing device may also comprise hollow enclosed chamber 1 embodied between two ends of the air-conditioning conduit 2 via its inlet and outlet opening, while for the purpose of securing the said ends in inlet and outlet openings of the hollow enclosed chamber 1 each of ends of air-conditioning conduit 2 are provided with the coaxial mouthpiece 7, the internal diameter of which is smaller than the internal diameter of the end of the air-conditioning conduit 2.

[24]

[25] **List of used reference numerals:**

[26] 1 - hollow enclosed chamber

[27] 2 - air-conditioning conduit

[28] 3 - pot part

[29] 4 - bottom (of the pot part)

[30] 5 - passage opening

[31] 6 - transitional section

[32] 7 - coaxial mouthpiece

[33] D2 - diameter of the air-conditioning conduit

[34] D5 - diameter of the reduced opening

Claims

[Claim 1] Absorbing device to be used especially for reducing pressure pulses caused by a compressor in an air-conditioning conduit of an air-conditioning system (2), while a coolant flow is reduced minimally, comprising a hollow enclosed chamber (1) integrated between two air-conditioning conduit ends (2) oriented toward each other, characterised in that the hollow enclosed chamber (1) consists of two pot parts (3) connectable to each other with their open ends, wherein each of the pot part (3) is an integral constituent of respective one of the two ends of the air-conditioning conduit (2) oriented toward each other and is provided with a reduced passage opening (5) interconnected with the internal space of the respective part of the air-conditioning conduit.

[Claim 2] Absorbing device according to the claim 1, characterised in that the reduced passage opening (5) is interconnected with the internal space of the respective part of the air-conditioning conduit (2) through a progressively widening transitional section (6), wherein diameter (D5) of the reduced opening (5) is smaller than the internal diameter (D2) of the air-conditioning conduit (2).

[Claim 3] Absorbing device according to the claim 1 or 2, characterised in that the transitional section (6) is inserted and secured as a separate part at the outlet of the air-conditioning conduit (2) leading into the pot part (3).

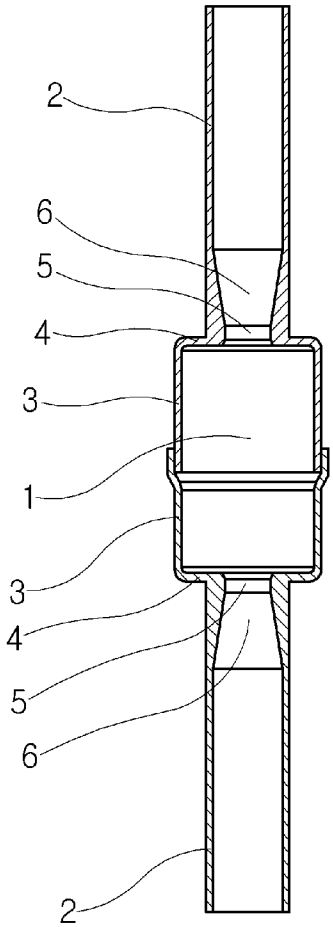
[Claim 4] Absorbing device according to the preceding claims 1, 2, and 3, characterised in that the two pot parts (3) are mutually connected to each other with their open ends by welding or soldering.

[Claim 5] Absorbing device to be used especially for reducing pressure pulses caused by a compressor in an air-conditioning conduit (2) of an air-conditioning system, while a coolant flow is reduced minimally, comprising a hollow enclosed chamber (1) integrated between two air-conditioning conduit ends (2) oriented toward each other, characterised in that each of the ends of the air-conditioning conduit (2) is provided, for the purpose of its securing in the inlet or outlet openings in the hollow enclosed chamber (1), with a coaxial mouthpiece (7), the diameter of which is smaller than the internal diameter of the end of the air-conditioning conduit (2).

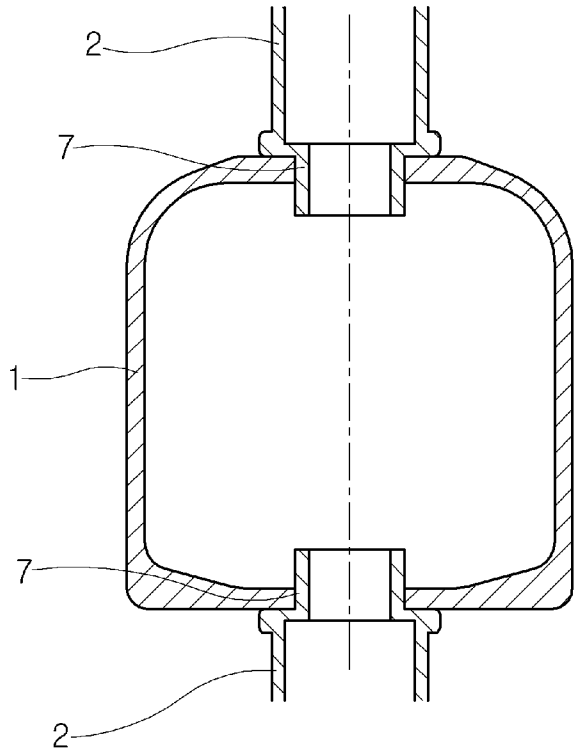
[Claim 6] Method for the production of the absorbing device according to the preceding claims 1 3, characterised in that at each of the ends of the air-

conditioning conduit a narrowing of the internal diameter of the tube is being formed by ramming and the thickness of the wall of said tube is also being increased to provide a sufficient amount of material for subsequent forming operations, in which the end of the tube is being widened gradually in several steps up to its final diameter, and at the same time a calibrating of the shape of pot parts, as well as reducing of the internal diameter of the tube are being performed, where in the case of a pot part having a peripheral edge flange, in another step, an additional peripheral fitted flange is being formed on the edge of this pot part for an attachment with adjacent part of the absorbing element by welding or soldering.

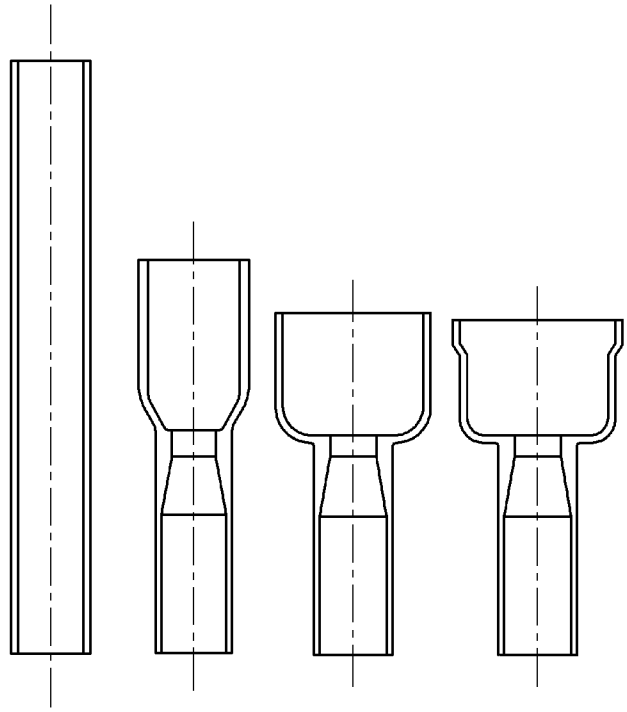
[Fig. 1]



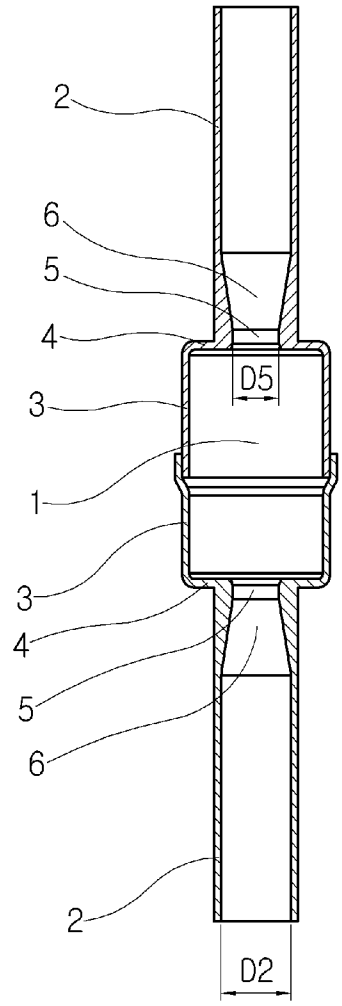
[Fig. 2]



[Fig. 3]



[Fig. 4]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2015/003482

A. CLASSIFICATION OF SUBJECT MATTER

F24F 1/40(2011.01)i, F24F 1/12(2011.01)i, B23K 1/14(2006.01)i

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)
F24F 1/40; B60H 1/32; F25B 41/00; B60H 1/00; F04B 39/00; F04B 53/00; B60H 1/26; F24F 5/00; F25D 23/00; F24F 1/12; B23K 1/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & keywords: air-conditioning system, compressure, coolant, absorbing device, pressure pulse, noise, chamber, conduit, and transition section

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2007-0115039 A (HALLA VISTEON CLIMATE CONTROL CORP.) 05 December 2007 See paragraphs [0021]-[0025], [0033]-[0052] and figures 1-6e.	1,4
Y		5
A		2-3,6
Y	JP 2011-012869 A (PANASONIC CORP.) 20 January 2011 See paragraphs [0029]-[0031] and figure 2.	5
A	KR 10-0307359 B1 (LG ELECTRONICS INC.) 24 September 2001 See page 3, line 17 - page 4, line 34 and figures 3, 5-6.	1-6
A	KR 10-2007-0096393 A (SAMSUNG GWANGJU ELECTRONICS CO., LTD.) 02 October 2007 See paragraphs [0043]-[0050] and figures 3-4.	1-6
A	KR 10-2011-0034847 A (HALLA VISTEON CLIMATE CONTROL CORP.) 06 April 2011 See paragraphs [0043]-[0058], claim 6, and figure 5.	1-6

☐ 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
"E" earlier application or patent but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed
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"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
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2015/003482

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 10-2007-0115039 A	05/12/2007	None	
JP 2011-012869 A	20/01/2011	None	
KR 10-0307359 B1	24/09/2001	KR 10-2000-0060144 A	16/10/2000
KR 10-2007-0096393 A	02/10/2007	WO 2007-108603 A1	27/09/2007
KR 10-2011-0034847 A	06/04/2011	KR 10-1183055 B1	20/09/2012