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(71) Applicant *(for all designated States except US)*: **ARCELIK ANONIM SIRKETI** [TR/TR]; E5 Ankara Asfalti Uzeri, Tuzla, 34950 Istanbul (TR).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **OGUZ, Emre** [TR/TR]; Arcelik Anonim Sirketi, E5 Ankara Asfalti Uzeri, Tuzla, 34950 Istanbul (TR). **ERINCIN, Burhan** [TR/TR]; Arcelik Anonim Sirketi, E5 Ankara Asfalti Uzeri, Tuzla, 34950 Istanbul (TR).

(74) Agent: **ANKARA PATENT BUREAU**; Bestekar Sokak No.10, Kavaklidere, 06680 Ankara (TR).

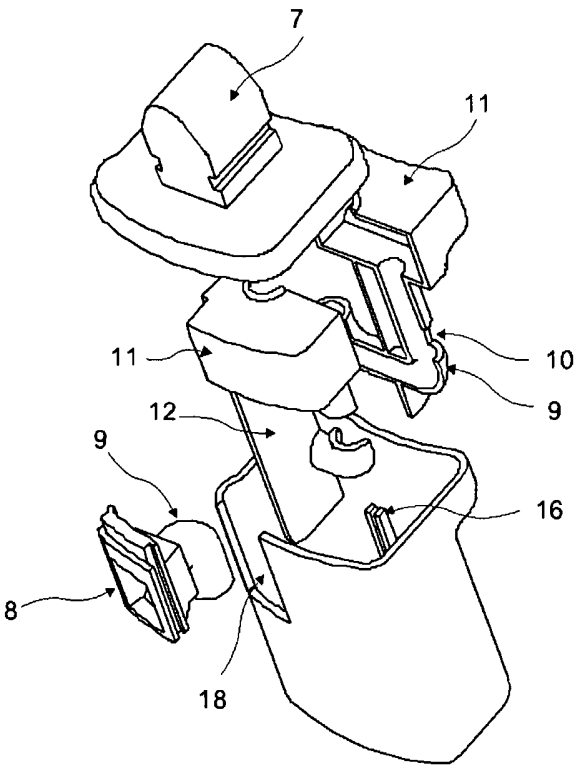
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(54) Title: A COMPRESSOR



(57) Abstract: This invention relates to a compressor (1) with a suction muffler (4) comprising a flow leading pipe (9) which enables the transfer of fluid into the cylinder (2) with less pressure loss and/or less heating up.

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Description

A COMPRESSOR

[001] This invention relates to a compressor, which comprises a suction muffler that minimizes noise.

[002] The suction mufflers in compressors are used for the purpose of dampening the pressure waves generated as a result of the opening and closing of the valve plate during the periodic movement and cycle of the piston and decreasing the sound power level of the compressor. Nonetheless the compressor performance is considerably affected by the decrease of fluid density caused by the heat transfer in the muffler and pressure loss in flow line. In the current state of the art, large volumes are used prior to the suction port to reduce fluid pressure loss, and due to heating of fluid waiting in this volume for several cycles, capacity and performance of the compressor is degraded. Although there is less heating up in applications where an enclosure is not utilized just before the suction port and where direct connection is made to suction port inlet by means of a conduit pipe, the pressure loss increases since fluid is drawn through the pipe and increasing the diameter of the pipe prevents dampening of the sound power level.

[003] In the current state of the art, in The United States of America Patent no. US4755108, a suction muffler in hermetic compressors comprising a body which reduces pressure loss and excessive heating of fluid and attenuates the pressure waves, and an insulated discharge chamber mounted on the suction manifold of the cylinder head is described. The body of the muffler is composed of two chambers and the muffler pipe line starting from muffler inlet is designed to meet the compressor suction pipe providing communication of fluid with these two enclosures by means of radial openings. In order to reduce contact between metal surfaces of cylinder head and the outlet portion of muffler positioned on the cylinder head, a metal coil spring is used. In this application the heating of fluid can not be completely prevented since the part used as fluid reservoir is surrounded by metal surfaces within the cylinder head and the reservoir volume is insufficient for large capacity compressors.

[004] In the current state of the art, in International Patent Application WO 00/52334, a suction muffler, the interior of which is divided into two resonance chambers and which is designed for decreasing compressor sound power level and increasing efficiency in hermetic compressors is described. The said muffler comprises an empty, rectangular prism shaped lower element with its top open and a upper element functioning as a lid. The upper element functioning as a lid comprises an empty chamber and a pipe shaped piece enabling connection with the compressor suction port. Two interconnected pieces are placed inside the muffler that is basically

comprised of a lower element with a rectangular prism shape and an upper element functioning as a lid. These pieces form a T shape when connected wherein one has various pins and projections corresponding to holes and recesses on the other by means of which two parts are interconnected. When the inner section comprising two pieces is positioned on the bottom of the muffler and the upper element functioning as a lid is closed, the upper element and the internal pieces constitute a third volume which is similar to the suction manifold. In this muffler, two plates, forming a T shape when connected using pins and projections on them and dividing the muffler chamber into two identical resonance chambers and an outlet volume on the top section when positioned in the body after they are connected, are described. In this type of application, volume can be adjusted by changing the height of the volume used as the suction reservoir. When the volume is large, the standby time of fluid and heating will increase thus decreasing the capacity; in the case of decreasing volume by decreasing height, the pressure loss will increase due to the decrease in distance between two horizontal planes during fluid intake. As a solution to these problems, introducing two co-acting small boxes positioned on connected pieces with only interfacing surfaces open is considered. In this way, it is possible to decrease the volume without lowering the height of the reservoir excessively and to decrease heat transmission by means of wall thicknesses of the two small boxes.

[005] The object of this invention is the realization of a compressor, which comprises a suction muffler, wherein the fluid flowing through, is taken into the cylinder with reduced pressure loss and/or less heating up.

[006] The compressor designed to fulfill the object of the present invention is illustrated in the attached figures, where:

[007] Figure 1 – is a sectional view of a compressor.

[008] Figure 2- is a perspective view of a suction muffler.

[009] Figure 3 – is a schematic view of a suction muffler.

[010] Figure 4 – is the exploded perspective view of a suction muffler.

[011] Figure 5- is the perspective view of a flow leading pipe comprising a suction chamber positioned above a separator.

[012] Figure 6- is the schematic view of a suction muffler in an alternative application of the said invention

[013] Figure 7 - is the schematic view of a suction muffler in another alternative application of the said invention.

[014] Elements shown in figures are numbered as follows:

1. Compressor
2. Cylinder
3. Cylinder head

4. Suction muffler
5. Valve table
6. Muffler outlet
7. Muffler head
8. Muffler suction inlet
9. Flow leading pipe
10. Opening
11. Suction chamber
12. Separator
13. Suction chamber inlet
14. Suction chamber outlet
15. Resonator chamber
16. Guide
17. Muffler body
18. Housing

[015] In household appliances, preferably in cooling devices, the circulation of fluid used for cooling is accomplished by a compressor (1).

[016] The compressor (1) comprises a cylinder (2), which provides pumping of the circulation fluid, a cylinder head (3) positioned on the cylinder (2) which leads the pumped and sucked circulation fluid, a valve table (5) onto which the cylinder head (3) is positioned, and a suction muffler (4), preferably made of plastic, which enables the circulation fluid, the acoustical energy of which is reduced, circulating inside to reach the cylinder (2) without heating up and preventing the noise that may be generated by the circulation fluid.

[017] The suction muffler (4) comprises a muffler body (17) onto which the parts are located, one or more separators (12) which divide the muffler body (17) into sections, at least two resonator chambers (15), attenuating vibrations, formed by the separator (12) dividing the interior of muffler body (17), a muffler head (7) which enables its mounting onto the cylinder head (3), a muffler outlet (6) that is positioned on the muffler head (7) which enables the transfer of the circulation fluid into the cylinder (2), a muffler suction inlet (8) that provides the entry of circulation fluid, one or more flow leading pipes (9) in the resonator chamber (15), through which circulation fluid flows, extending from the muffler suction inlet (8) to the muffler outlet (6), a suction chamber (11) which is positioned on the flow leading pipe (9) and does not contact the muffler body (17) thus minimizing heat transfer to the fluid and reducing the acoustic energy inside while functioning as a fluid reservoir, and one or more openings (10) positioned on the flow leading pipe (9) where each opens to at least one resonator chamber (15) and provides attenuation of pressure waves.

[018] The suction chamber (11) comprises a suction chamber inlet (13) and a suction chamber outlet (14) where both are connected to flow leading pipe (9).

[019] The muffler body (17) comprises one or more guides (16) by means of which separator (12) is attached and a housing (18), which enables the fastening of the suction muffler inlet (8).

[020] In the preferred embodiment of the present invention, the suction chamber (11) is positioned on the separator (9).

[021] In yet one other preferred embodiment of the present invention suction muffler (4) comprises a suction chamber (11) in the flow direction of the fluid, that has a larger cross sectional area than that of the flow leading pipe (9).

[022] In another preferred embodiment of the present invention, suction muffler (4) comprises a suction chamber (11) which enables the creation of a fluid volume just as much as the stroke volume prior to suction and ensures the fluid to be taken into the cylinder (2) primarily from this volume with reduced pressure loss and/or reduced heating up.

[023] In the application, which is the object of the present invention, when the refrigerant fluid coming from the evaporator to which the compressor (1) is connected enters into the compressor (1), it is taken into the suction muffler (4) by way of the suction inlet (8). The fluid flowing in the flow leading pipe (9) in the suction muffler (4) first enters the suction chamber (11) and is transferred to the cylinder (2) by means of the muffler outlet (6). When the suction valve plate opens during suction phase of the compressor (1) the fluid suction starts from muffler head (7). The suction chamber (11) is connected by the suction chamber outlet (14), and the fluid suction of the compressor (1) during suction stroke is actuated from the suction chamber (11) with a volume that is equal or higher than the stroke volume, thus reducing suction phase losses. Thus, an advantage is presented by means of reducing the input power compared to mufflers where fluid flows only through pipes.

[024] In another application of the present invention, suction muffler (4) comprises a suction chamber (11) positioned under the suction muffler (4) which enables the fluid to make an approximately 180° turn on the flow leading pipe (9). Suction chamber (11), which is positioned in the section of the flow leading pipe (9) where fluid makes an approximately 180° turn, functions both as a flow line and a muffler and contributes to the reflection of pressure waves (Figure 4).

[025] With the application which is the object of the present invention, since the suction chamber (11) is positioned independent of the muffler body (17) onto the separator (9) inside the suction muffler (4) without contacting the muffler body (17), the volume of the suction chamber (11) can be adjusted as needed and the heat transfer to the fluid is reduced by the extra wall thickness of suction chamber (11) which is insulated from

surroundings by the muffler body (17).

[026] In another application of the present invention, suction muffler (4) comprises a suction chamber (11) and a flow leading pipe (9) made of an insulating material.

[027] In the application of the present invention, heating up of the fluid is prevented since heat transfer surface area is reduced due to small volume of the suction chamber (11), pressure loss is reduced, since fluid intake is made from this volume during circulation, and at the same time the advantage of dampening effect of sound waves of this additional volume is used.

Claims

[001] A compressor (1) comprising a cylinder (2) enabling pumping of the circulation fluid inside, a suction muffler (4) enabling the fluid with reduced acoustic energy circulating inside to reach the cylinder (2) without heating up and preventing the noise which may be generated by the circulation fluid, a muffler body (17) onto which parts are positioned and one or more flow leading pipes (9) inside the muffler body (17) through which circulation fluid flows, and characterized by a suction muffler (4) comprising a suction chamber (11) positioned on the flow leading pipes (9), minimizing heat transfer to the fluid by not contacting the muffler body (17), functioning as a fluid reservoir and enabling reduction of acoustic energy inside.

[002] A compressor (1) as in Claim 1, characterized by a suction muffler (4) comprising one or more separators (12) dividing the interior of muffler body (17) into sections, at least two resonator chambers (15) created by dividing the interior of muffler body (17) by the separator (12) which dampens vibrations, and a suction chamber (11) that is positioned in at least one of the resonator chambers (15).

[003] A compressor (1) as in Claims 1 and 2, characterized by a suction muffler (4) comprising a cylinder head (3) positioned on the cylinder (2) directing the sucked and pumped circulation fluid, a muffler head (7) that enables the connection to the cylinder head (3), a muffler outlet (6) positioned on the muffler head (7) which enables transfer of circulation fluid into the cylinder (2), a muffler suction inlet (8) which enables intake of circulation fluid and a flow leading pipe (9) the outlet of which is formed by the muffler suction inlet (8) and the muffler outlet (6).

[004] A compressor (1) as in Claim 1 to 3 that is characterized by a suction muffler (4) in the direction of fluid flow, comprising a suction chamber (11) that has a greater cross sectional area than that of the flow leading pipe (9).

[005] A compressor (1) as in Claim 1 to 4, characterized by a suction muffler (4) comprising a suction chamber (11) that enables the creation of a volume prior to suction identical to that of the stroke volume and makes fluid suction from this volume and provides the fluid to be transferred to the cylinder (2) with reduced pressure loss and/or less heating up.

[006] A compressor (1) as in any one of the claims above, characterized by a suction muffler (4) comprising a suction chamber (11) positioned on the separator (9).

[007] A compressor (1) as in Claim 1 to 6 characterized by a suction muffler (4) comprising a suction chamber (11) having a suction inlet (13) and a suction

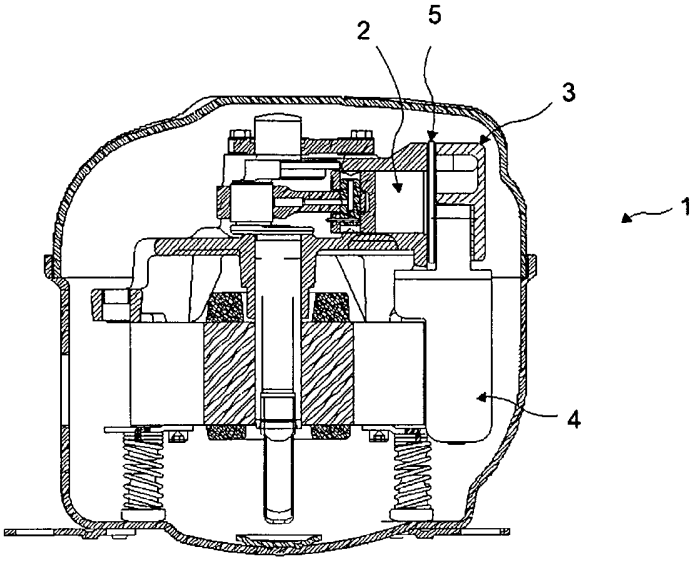
outlet (14) of which are connected to the flow leading pipe (9).

[008] A compressor (1) as in Claims 1 to 7, characterized by a suction muffler (4) comprising a suction chamber (11) functioning as a fluid tank, a fluid flow line and as a muffler, and positioned below the flow leading pipe (9) so as to make the fluid perform an approximately 180° turn.

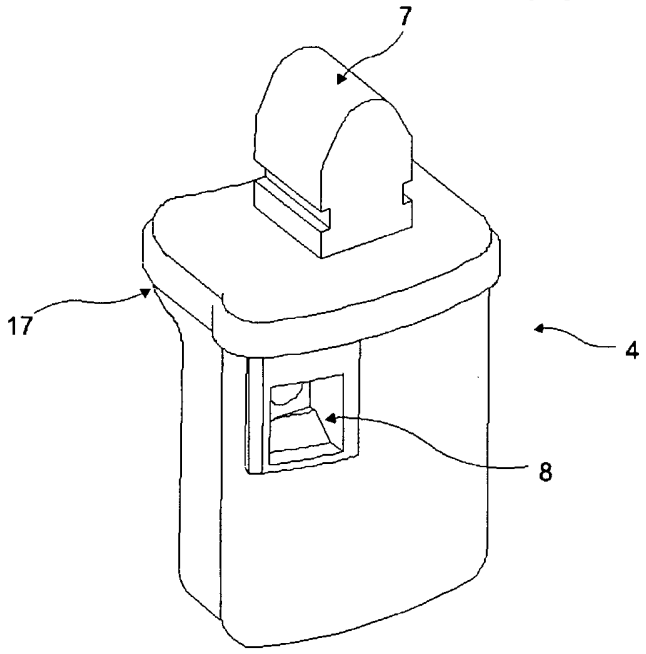
[009] A compressor (1) as in any one of the claims above, characterized by a suction muffler (4), which comprises a suction chamber (11) where heat transfer to the fluid can be reduced by means of its extra wall thickness.

[010] A compressor (1) as in any one of the claims above, characterized by a suction muffler (4) comprising a suction chamber (11) and a flow leading pipe (9) made of insulated material.

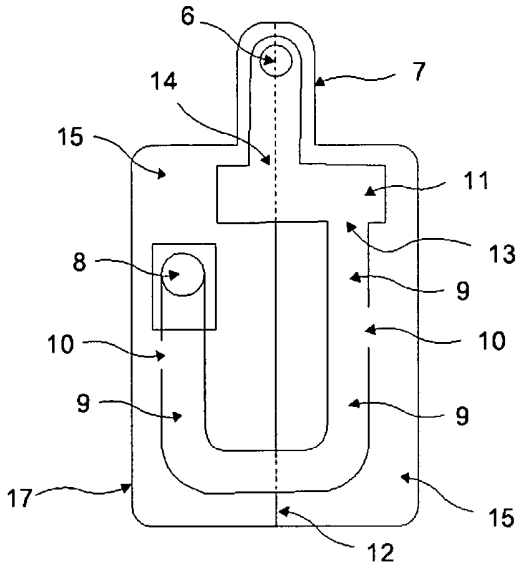
[Fig. 001]



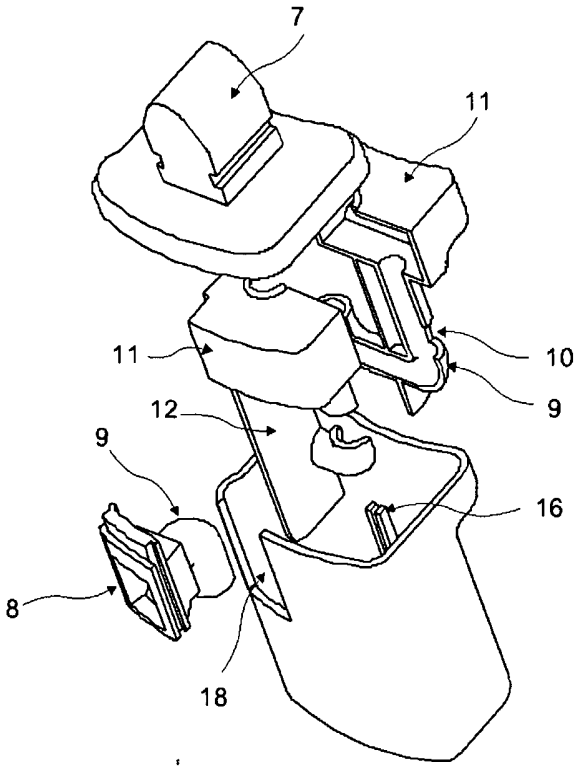
[Fig. 002]



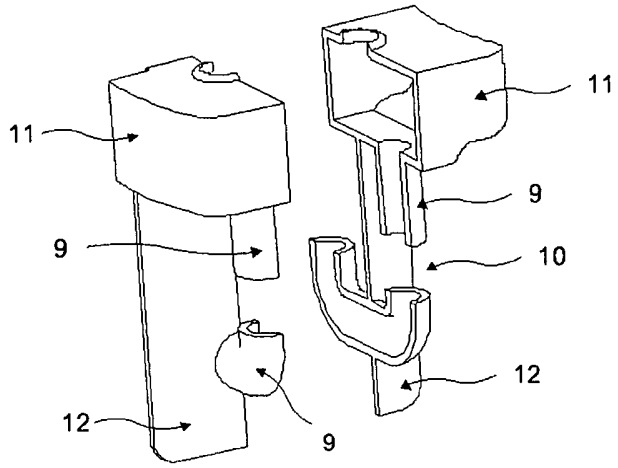
[Fig. 003]



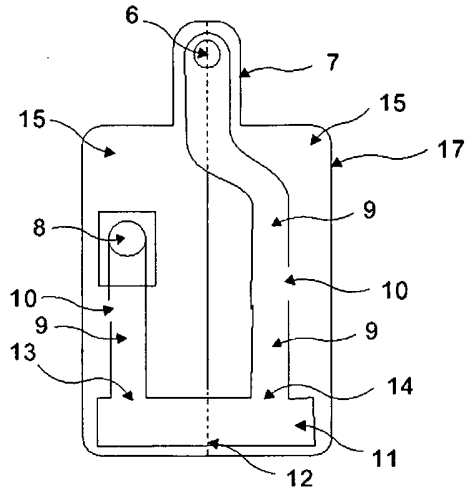
[Fig. 004]



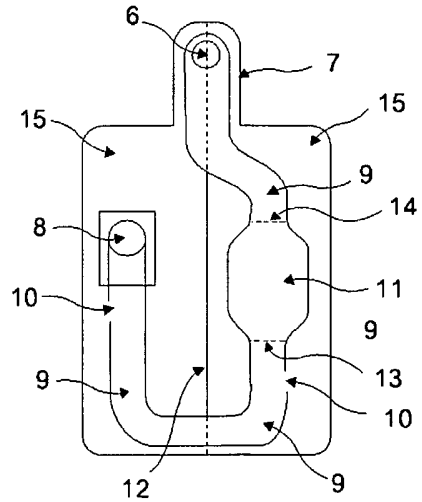
[Fig. 005]



[Fig. 006]



[Fig. 007]



INTERNATIONAL SEARCH REPORT

IB2005/052300

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F04B39/00 F04B39/02

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)
IPC 7 F04B

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)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 201 640 A (HEINZELMANN ET AL) 13 April 1993 (1993-04-13) abstract; figures column 3, line 63 - column 4, line 8 column 6, lines 8-25	1-10
A	US 5 762 478 A (LEE ET AL) 9 June 1998 (1998-06-09) abstract; figures column 2, lines 1-10 column 4, lines 33-44 column 5, lines 34-55 claim 6	1-10
A	EP 1 347 175 A (MATSUSHITA REFRIGERATION COMPANY) 24 September 2003 (2003-09-24) abstract; figure 5 paragraph '0015! paragraph '0031!	1-10

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☒ Patent family members are listed in annex.

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

IB2005/052300

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5201640 A	13-04-1993	BR 9102288 A	05-01-1993
		CN 1067097 A	16-12-1992
		DE 4217591 A1	03-12-1992
		ES 2068083 A2	01-04-1995
		FR 2677076 A1	04-12-1992
		GB 2256229 A	02-12-1992
		IT 1258912 B	01-03-1996
		JP 3225090 B2	05-11-2001
		JP 5195953 A	06-08-1993
		KR 244592 B1	02-03-2000
US 5762478 A	09-06-1998	BR 9600950 A	30-12-1997
		CN 1137098 A	04-12-1996
		IT RM960151 A1	08-09-1997
		JP 2944031 B2	30-08-1999
		JP 8247032 A	24-09-1996
		KR 143142 B1	01-08-1998
EP 1347175 A	24-09-2003	AU 2409402 A	11-06-2002
		BR 0115642 A	10-02-2004
		CN 1488038 A	07-04-2004
		WO 0244565 A1	06-06-2002
		JP 2002227766 A	14-08-2002