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(71) Applicant: **MATSUSHITA ELECTRIC INDUSTRIAL
CO., LTD.**

Kadoma-shi, Osaka 571-8501 (JP)

(72) Inventors:

• **Tokura, Satoshi**

Ohtsu-shi, Shiga 520-2101 (JP)

• **Matsumoto, Yasuaki**

Otsu-shi, Shiga 520-2153 (JP)

• **Hiratani, Hisashi**

Otsu-shi, Shiga 520-2134 (JP)

• **Nishida, Akira**

Kusatsu-shi, Shiga 525-0071 (JP)

• **Banba, Masahiro**

Kanzaki-gun, Shiga 529-1414 (JP)

• **Hamada, Masayuki**

Kusatsu-shi, Shiga 525-0041 (JP)

(74) Representative: **Grünecker, Kinkeldey,**

Stockmair & Schwanhäusser Anwaltssozietät

Maximilianstrasse 58

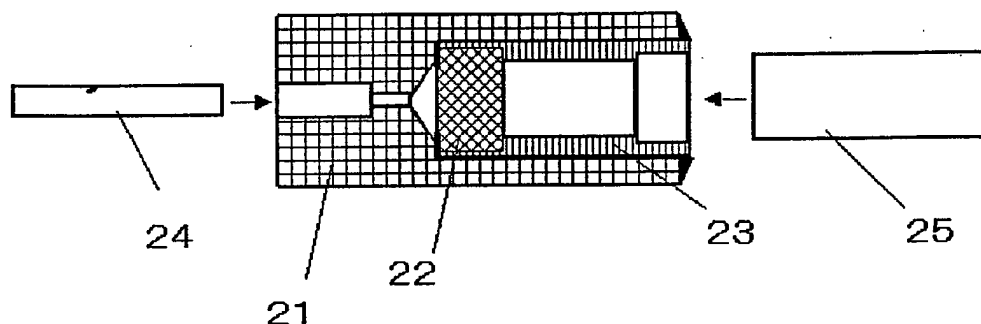
80538 München (DE)

(54) **Silencer for air conditioner**

(57) In a refrigeration cycle including an indoor unit heat exchanger, an outdoor unit heat exchanger, and a throttling device (24,34,44,54), a silencer (21,31,41,51) having a filter (22,32,42,52) formed by compressing a single metal wire or un-cut strand wire inside is dis-

posed. The silencer (21,31,41,51) suppresses noise released from the throttling device (24,34,44,54). The silencer (21,31,41,51) prevents adverse effects of dust generated in the refrigeration cycle on the refrigeration cycle.

Fig. 1



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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a silencer for an air conditioner installed in a refrigeration cycle.

BACKGROUND OF THE INVENTION

[0002] A re-heat dehumidifying function generally installed in an air conditioner recently requires a decompression device (throttling device) in an indoor unit. The throttling device generates refrigerant noise, and it is important to reduce the noise in order to prevent the noise from being directly transmitted to users in a room.

[0003] The refrigeration cycle includes a refrigerant pipe for connecting a compressor, a heat exchanger in an indoor unit, a heat exchanger in an outdoor unit, and a refrigerant flow rate adjuster. The re-heat dehumidifying function is dehumidifying without lowering a blow-out temperature. The indoor unit includes a decompression device for using a portion of the heat exchanger in an indoor unit is used as a condenser, and other portion of the exchanger is used an evaporator. And the heat exchanger dehumidifies while raising a temperature at one side as the condenser and lowering a temperature at other side as the evaporator.

[0004] A refrigeration cycle having a conventional re-heat dehumidifying function will be explained.

[0005] Fig. 5 is a diagram of a refrigeration cycle of an air conditioner having the reheat dehumidifying function. The refrigeration cycle includes a compressor 11, a four-way valve 12, an outdoor heat exchanger 13, a decompression device 14, indoor heat exchangers 15 and 18, a dehumidifying valve 15, and a throttling device 17. A silencer 19 is disposed at both sides of the throttling device 17. The silencer 19 mainly lowers a noise generated from the throttling device 17, and is provided at both sides of the throttling device 17.

[0006] These components are sequentially linked to compose the refrigeration cycle. In a reheat dehumidifying operation, refrigerant flows in a direction of arrow A, and at this moment, the dehumidifying valve 16 is closed, and the refrigerant flows into the throttling device 17. At this moment, a noise is released from the throttling device 17.

[0007] A vibration absorbing rubber (not shown) for absorbing the noise, or a muffler type silencer (not shown) for stabilizing a state of the refrigerant at an inlet of the throttling device 17 is provided in the throttling device 17. Or at inlet and outlet of the refrigerant, or either of them, a filter of porous material or mesh is disposed to fragment vapor slag and straighten the refrigerant flow, thereby absorbing and dissipating the noise.

[0008] However, the vibration absorbing rubber can not absorb the noise sufficiently. The muffler type silencer is hard to stabilize the state of the refrigerant depending on change in state of the liquid refrigerant due to

changes in air conditioning requirements or conditions, and requires a large space for accommodating it.

[0009] The filter is effective for reducing the noise, and is relatively small against the effect due to difference in operating state, and is therefore considered to be a more excellent method than the two methods mentioned above. Regarding the filter, however, whole refrigerant must be passed through the filter substantially, and a considerably fine filter is needed, and the filter may be often loaded with dust particles and the refrigerant cycle may be closed. If an area of the filter is increased to prevent this problem, a large space is needed for accommodating it.

[0010] The filter requires a certain width for reducing the noise, and may need plural phases, which increases its cost. Or raveling or breaking of the filter itself may form particles, and dust may be released from the filter itself, and the refrigeration cycle may be clogged. Besides, the filter, having uneven density, does not have the silencing effect sufficiently, or the particles are released from the filter, and the dust may flow into the throttling device.

SUMMARY OF THE INVENTION

[0011] A silencer is disposed in a refrigeration cycle including an indoor unit heat exchanger, an outdoor unit heat exchanger, a throttling device, and a refrigerant pipe, and suppresses noise released from the throttling device. The silencer includes a filter made of a compressed metal wire having a thickness in a direction of a flow of the refrigerant.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Fig. 1 is a sectional view of a silencer according to exemplary embodiment 1 of the present invention.

[0013] Fig. 2 is a sectional view of a silencer according to exemplary embodiment 4 of the invention.

[0014] Fig. 3 is a sectional view of a silencer according to exemplary embodiment 5 of the invention.

[0015] Fig. 4 is a sectional view of a silencer according to exemplary embodiment 6 of the invention.

[0016] Fig. 5 shows a refrigeration cycle of an air conditioner.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Exemplary Embodiment 1)

[0017] Silencers of air conditioners according to exemplary embodiments of the present invention are provided in a refrigeration cycle shown in Fig. 5.

[0018] Fig. 1 is a sectional view of a silencer according to exemplary embodiment 1 of the invention. In Fig. 1, a filter-fixing member 23 for fixing a filter 22 is provided inside of a silencer main body 21. The filter 22 is formed

by compressing metal wires, such as iron wires. A throttling device 24 which releases noise of refrigerant is attached to the silencer main body 21 directly or via a lead pipe. The refrigerant passing through the throttling device also passes basically through the filter 22. A copper pipe 25 is connected to the silencer main body 21 opposite to the throttling device 24. The silencer is disposed at least at both sides of the throttling device for reducing the noise by stabilizing a state of the refrigerant.

[0019] The filter 22 has a specific thickness in a direction of a flow of the refrigerant, and is formed by compressing iron wires. This arrangement provides a silencer of compact size, low cost, and large noise lowering effect.

(Exemplary Embodiment 2)

[0020] The filter according to embodiment 1 is formed by compressing metal wires, such as iron wires, and may create a little dust and be broken. According to exemplary embodiment 2 of the invention, a filter, being made of a metal wire, such as a single iron wire or a single strand wire without intermediate cut, and therefore, the wire is hardly broken.

(Exemplary Embodiment 3)

[0021] In order to make the filter according to embodiment 1 have an uniform density for a great silencing effect in a minimum space, according to exemplary embodiment 3, the iron wire is once processed into a spiral shape, and then compressed. This provides the filter with the uniform density of a wire mesh, thus providing a notable noise lowering effect.

(Exemplary Embodiment 4)

[0022] Fig. 2 is a sectional view of a silencer according to exemplary embodiment 4 of the invention. Inside of a silencer main body 31, a filter fixing member 33 for fixing a filter 32 is inserted. A throttling device 34 is attached to one end of the silencer main body 31 directly or via a lead pipe. In the silencer main body 31, a copper pipe 35 is connected opposite to the throttling device 34. The silencer main body 31 has a bypass hole 37 which communicates with a bypass passage 36 of refrigerant flowing by evading the filter 32. This silencer is provided in the mainstream of the refrigerant, and most of the refrigerant passes through the filter 32 in the silencer main body. If being mixed into a refrigeration cycle, dust may be collected in the filter 31, which may thus be clogged. In such a case, the refrigerant flows into the bypass passage of the filter 31 through the bypass hole 37. This arrangement allows an operation of the air conditioner to continue without affecting the refrigeration cycle.

(Exemplary Embodiment 5)

[0023] Fig. 3 is a sectional view of a silencer according to exemplary embodiment 5 of the invention. Inside of a silencer main body 41, a filter fixing member 43 for fixing a filter 42 is inserted. A throttling device 44 is attached to one end of the silencer main body 41 directly or via a lead pipe. In the silencer main body 41, a copper pipe 45 is connected at the opposite side of the throttling device 44. The silencer main body 41 has a bypass hole 47 which communicates with a bypass passage 46 of refrigerant flowing by evading the filter 42, and the bypass passage 46 is formed separately at outside of the silencer main body 41. Even if dust formed in the refrigeration cycle is extremely collected in the filter 42 until the filter 42 is clogged, the refrigerant flows in the bypass passage 46, so that the dust may not affect the refrigeration cycle. In an ordinary state in which the dust is not extremely collected in the filter 42, even if the flow of the refrigerant is concentrated in the bypass hole 47, noise of the refrigerant noise is not generated.

[0024] In this silencer, a passing resistance of the refrigerant flowing in the bypass passage 46 through the bypass hole 47 is set larger than a passing resistance of the filter 42 in which the dust is not collected extremely. Therefore, while the flow of the refrigerant is maintained, flow of refrigerant is not concentrated. The bypass passage 46 allows the silencer to assure reliability, and to reduce the noise.

(Exemplary Embodiment 6)

[0025] Fig. 4 is a sectional view of a silencer according to exemplary embodiment 6 of the invention. Inside of a silencer main body 51, a filter fixing member 53 for fixing a filter 52 is inserted. A throttling device 54 is attached to one end of the silencer main body 51 directly or via a lead pipe. In the silencer main body 51, a copper pipe 55 is connected at the opposite side of the throttling device 54. The silencer main body 51 has a bypass hole 57 which communicates with a bypass passage 56 of refrigerant flowing by evading the filter 52. The bypass passage 56 is formed by cutting a threaded groove between the silencer main body 51 and the filter fixing member 53, at the outside of the filter fixing member 53 or at the inside contacting with the filter fixing member 53 of the silencer main body 51. Since the, bypass passage 56 has a specified passing resistance, the same effect as in the silencer of embodiment 5 is obtained. Moreover, unlike the silencer in Fig. 3, it is not necessary to dispose the bypass passage 56 separately, and this provides a low noise silencer of compact design and low cost.

(Exemplary Embodiment 7)

[0026] According to exemplary embodiment 7 of the invention, a flow rate in the bypass passage 56 accord-

ing to embodiment 6 is set lower than that in the filter 52. Therefore, in case of abnormality in which the filter 52 is clogged, while the flow rate of refrigerant in the bypass passage is maintained, the refrigerant is prevented from flowing into the filter 52 in normal state, and thus a noise may be suppressed. 5

[0027] In the filter according to the foregoing embodiments, the metal wires employ iron wires of low cost, but may employ other metal wires. 10

Claims

1. A silencer disposed in a refrigeration cycle including an indoor unit heat exchanger, an outdoor unit heat exchanger, a throttling device, and a refrigerant piping, for suppressing noise released from said throttling device, said silencer comprising: 15
 a filter formed of compressed a metal wire, said filter having a thickness in a direction of a flow of refrigerant. 20
2. The silencer of claim 1, wherein said metal wire is a single metal wire. 25
3. The silencer of claim 1, wherein said metal wire is an uncut strand wire.
4. The silencer of claim 1, wherein the metal wire is spiral. 30
5. The silencer of claim 1, further comprising:
 a bypass passage for allowing the refrigerant to flow by evading said filter. 35
6. The silencer of claim 5, wherein a passing resistance of the refrigerant flowing in said bypass passage is larger than a passing resistance of the refrigerant flowing in said filter. 40
7. The silencer of claim 5, wherein said bypass passage has a thread shape. 45
8. The silencer of claim 5, wherein a flow rate of the refrigerant flowing in said bypass passage is smaller than a flow rate of the refrigerant flowing in said filter. 50
9. The silencer of claim 1, wherein said metal wire is made of iron. 55

Fig. 1

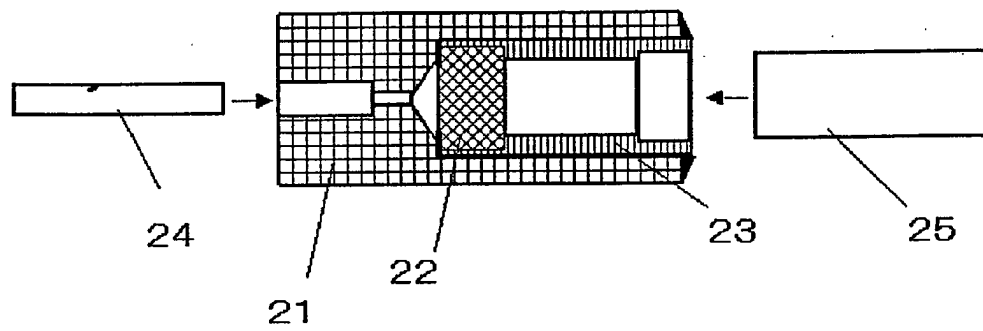


Fig. 2

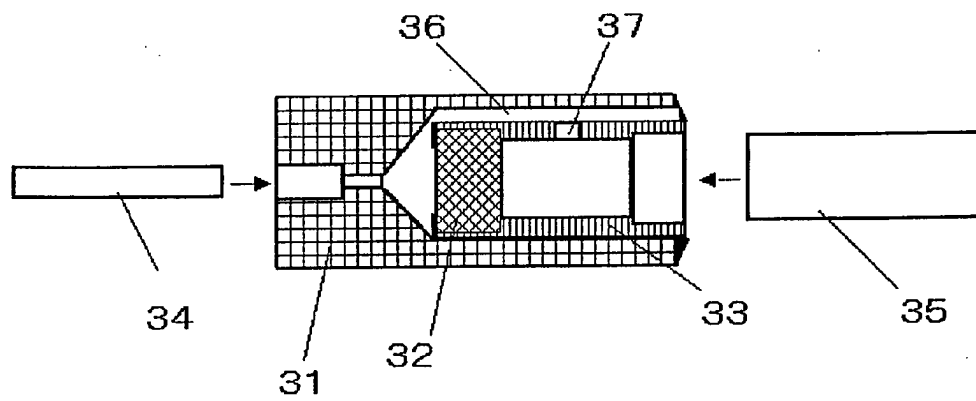


Fig. 3

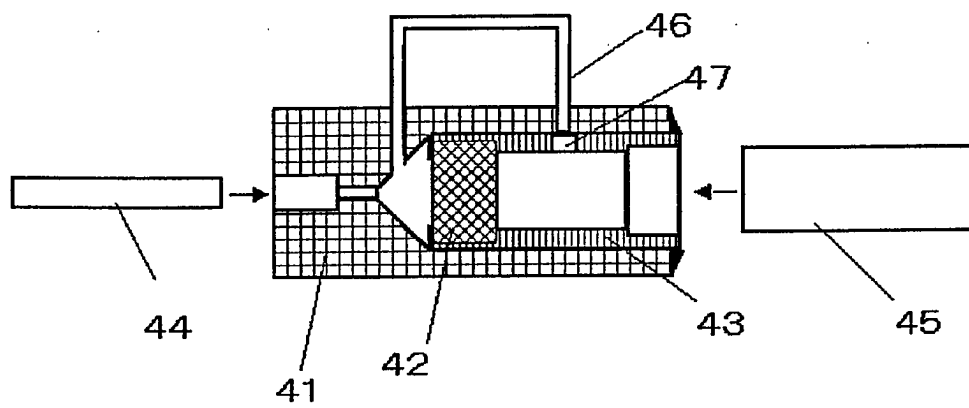


Fig. 4

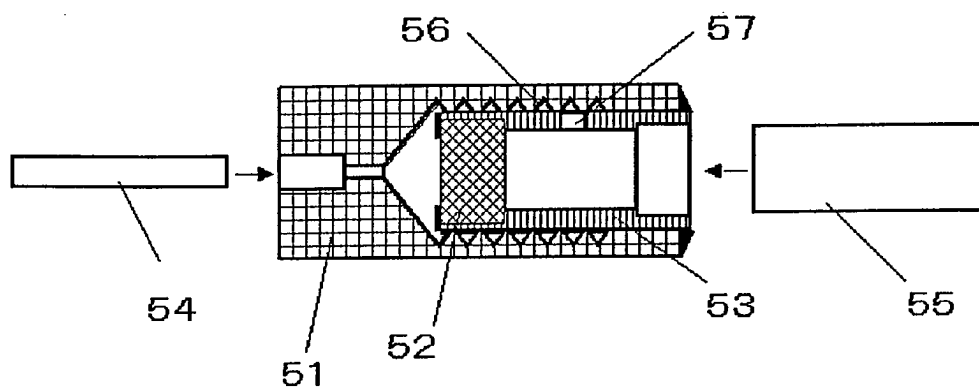


Fig. 5

