

SUCTION MUFFLER FOR RECIPROCATING COMPRESSOR AND RECIPROCATING COMPRESSOR

TECHNICAL FIELD

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The present disclosure relates to reciprocating compressors and in particular to a suction muffler for a reciprocating compressor.

BACKGROUND

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A reciprocating compressor is an apparatus configured to compress fluid by suction, compression, and discharge of a refrigerant through a reciprocating movement of a piston inside a cylinder.

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Reciprocating compressors often comprise a suction muffler to reduce noise during suction of the refrigerant into the cylinder. An issue with reciprocating compressors is that due to the motion of the drive unit or compression unit of the compressor, part of the compressor may come into contact with a shell due to vibration generated when the compressor is operated or is transported. Such contact can cause a large amount of friction noise and may also damage parts of the compressor. In particular, the suction muffler which is often made of polymer.

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In view of recent development of micro compressor, there is increasing challenge on the above issue. The size of the cavity within the shell of compressor is smaller and the gap between the suction muffler and its neighboring compressor components gets narrower.

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SUMMARY

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According to a first aspect of the present disclosure, a suction muffler for a reciprocating compressor comprises: a muffler body; and a damper protruding from the muffler body.

The damper protrudes outwards from the muffler body. The damper may protrude from the muffler body towards the shell of the compressor and thus may be configured to absorb impacts between the suction muffler and shell. Alternatively, the damper may protrude towards the stator or the connection terminal of the compressor. Multiple dampers may be provided to absorb impact and provide a clearance between the suction muffler and other parts of the compressor. The damper may extend from any part of the muffler body.

In some embodiments damper absorbs impacts between the suction muffler and the shell or other parts of the reciprocating compressor during transportation or operation of the reciprocating compressor. This can prevent damage to the suction muffler due to impacts and potentially reduce noise during operation of the reciprocating compressor.

The damper may ensure that there is a clearance between the suction muffler and parts of the compressor such as the shell, the stator and/or the terminal. During use, these parts of the compressor may become hot, thus the damper may reduce heat transfer between the parts of the compressor that become hot and the refrigerant.

In some embodiments, the damper extends into a muffling space within the muffler body. The damper may extend radially into the muffling space or may extend circumferentially around the muffling space. The damper may absorb vibrations in refrigerant flow within the muffler body and therefore reduce noise during operation.

In some embodiments, a plurality of dampers is provided and each of the dampers extends by a different length into the muffling space within the muffler body. Since the dampers extend by different lengths into the muffling space, the dampers have different natural frequencies and absorb vibrations at different frequencies.

Thus, the damper or dampers may provide three advantages: a reduction in noise due to impacts, a reduction in noise by regulating frequency of the refrigerant flow and a reduction in heat transfer.

The damper may extend from a muffler insert provided in a muffling space within the muffler body.

5 The damper may protrude from the body of the suction muffler by at least 2mm. The damper may protrude from the muffler body by less than 5mm. The distance that the damper protrudes from the muffler body may be the same or less than the clearance between the shell and the suction muffler.

10 The damper and the muffler body may be formed from different materials. The damper may be formed from a material that is softer than the muffler body. This allows the damper to absorb impacts and reduce noise.

15 The damper may be formed from an elastomeric material. The elastomeric material may be able to withstand temperature of at least 200 degrees Celsius. Examples of such elastomeric materials are butadiene rubber (NBR) and hydrogenated nitrile butadiene rubber (HNBR).

20 According to a second aspect of the present disclosure a reciprocating compressor is provided. The reciprocating compressor comprises a hermetically sealed shell; a drive unit and a compression unit arranged within the hermetically sealed shell, the compression unit being configured to draw in and compress a refrigerant from within the hermetically sealed shell and the drive unit being configured to drive the compression unit; and a suction muffler provided on an inlet of the compression unit, the suction muffler comprising a muffler body; and a damper protruding from the muffler body and configured to absorb impacts between the suction muffler and the hermetically sealed shell.

30 The damper may extend into a muffling space within the muffler body. The damper may extend radially into the muffling space or circumferentially around the muffling space. A plurality of dampers may be provided protruding from the muffler body and each damper of the plurality of dampers may extend radially by a different length into the muffling space within the muffler body.

The damper may extend from a muffler insert provided in a muffling space within the muffler body.

The clearance between the hermetically sealed shell and the suction muffler may be 2mm or more and the damper may protrude from the body of the suction muffler by at least 2mm. The damper may protrude from the body of the suction muffler by less than 5mm. The distance that the damper protrudes from the muffler body may be the same or less than the clearance between the shell and the suction muffler.

The damper and the muffler body may be formed from different materials. The damper may be formed from a material that is softer than the muffler body. This allows the damper to absorb impacts and reduce noise. The damper may be formed from an elastomeric material. The elastomeric material may be butadiene rubber (NBR) or hydrogenated nitrile butadiene rubber (HNBR).

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, embodiments of the present invention will be described as non-limiting examples with reference to the accompanying drawings in which:

FIG.1A shows a cross sectional view of a reciprocating compressor;

FIG.1B shows an isometric view of the reciprocating compressor shown in FIG.1A;

FIG.1C shows an isometric view of the reciprocating compressor shown in FIG.1A excluding a shell;

FIG.2A shows an isometric view of the suction muffler of the reciprocating compressor shown in FIG.1A;

FIG.2B shows the parts of the suction muffler shown in FIG.2A;

FIG.3A shows a cross sectional view of a reciprocating compressor according to an embodiment of the present invention;

FIG.3B shows an isometric view of the reciprocating compressor shown in FIG.3A;

FIG.3C shows an isometric view of the reciprocating compressor shown in FIG.3A
5 excluding a shell;

FIG.4A shows an isometric view of the suction muffler of the reciprocating compressor
shown in FIG.3A;

10 FIG.4B shows the parts of the suction muffler shown in FIG.4A;

FIG.5A shows an isometric view of a suction muffler according to an embodiment of
the present invention;

15 FIG.5B shows the parts of the suction muffler shown in FIG.5A;

FIG.5C shows the parts of the lower portion of the suction muffler shown in FIG.5B;

FIG.6A shows an isometric view of a suction muffler according to an embodiment of
20 the present invention;

FIG.6B shows the parts of the suction muffler shown in FIG.6A;

FIG.6C shows the parts of the lower portion of the suction muffler shown in FIG.6B;
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FIG.7A show a suction muffler according to an embodiment of the present invention;

FIG.7B shows the parts of the suction muffler shown in FIG.7A;

30 FIG.8A shows a front view of a suction muffler according to an embodiment of the
present invention;

FIG.8B shows a rear view of the suction muffler shown in FIG.8A;

FIG.8C shows a front view of the parts of the suction muffler shown in FIG.8A; and

FIG.8D shows a rear view of the parts of the suction muffler shown in FIG.8A.

5 DETAILED DESCRIPTION

FIG.1A to FIG.1C show a reciprocating compressor. FIG.1A is a cross sectional view, FIG.1B is an isometric view and FIG.1C is an isometric view without a shell. The reciprocating compressor 100 is a hermetic compressor which is hermetically sealed
10 within a shell. The shell is formed from an upper shell portion and a lower shell portion 101. It is noted that the upper shell portion is not shown in FIG.1A or FIG.1B.

The reciprocating compressor 100 comprises a drive portion and a compression portion. The drive portion functions as an electric motor and comprises a rotor 111 and
15 a stator 112. The rotor 111 is arranged within the stator 112. The rotor 111 is attached to a crankshaft 120 which drives the compression portion. The crankshaft 120 comprises a main shaft portion 121 and an eccentric shaft portion 122. An electrical connection 113 is conductively coupled to windings of the stator 112 and/or the rotor 111.

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The compression portion comprises a piston 131 which is arranged to reciprocate in a cylinder 132 formed in a cylinder block 133. The piston 131 is coupled to the eccentric shaft portion 122 of the crankshaft 120 by a connecting rod 134.

25 An upper section of the main shaft 121 of the crankshaft 120 is arranged within a main bearing 105 which supports the eccentric shaft portion 122 of the crankshaft 120. The main bearing 105 is coupled to the cylinder block 133. The main bearing 105 and the cylinder block 133 are supported by support legs 106 which rest on the stator 112. The stator 112 is supported above the base of the shell by four suspension springs 107.

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A valve plate 135 is disposed at the end surface of the cylinder 132 that is distal from the crankshaft 120. The valve plate 135 has a suction hole 136 and a discharge hole 137. The suction hole 136 has a suction valve reed and the discharge hole 137 has a discharge valve reed. A cylinder head 138 is disposed over the valve plate 135. The

cylinder head 138 forms a discharge chamber 139 which is in fluid communication with the discharge hole 137. A suction muffler 200 has a suction port 201 arranged over the suction hole 136. The suction muffler 200 has a suction muffler inlet 202 which is in fluid communication with the interior of the shell of the reciprocating compressor 100. The suction muffler 200 will be described in more detail below with reference to FIG.2A and FIG.2B.

The discharge chamber 139 of the cylinder head 138 is coupled to discharge muffler 140 which is joined to a discharge tube 141. The discharge tube 141 is coupled to a discharge outlet 142 which extends from the shell of the reciprocating compressor 100. The discharge outlet 142 is coupled to a refrigeration cycle. An inlet pipe 143 is coupled to the output of the refrigeration cycle and is connected to the interior of the shell. The interior of the shell of the reciprocating compressor 100 is filled with a refrigerant gas.

In operation, a voltage is applied across the electrical connection 113, this causes a current to flow in the windings of the stator 112 and/or the rotor 111. This current results in a torque which causes the rotor 111 to rotate within the stator 112. This in turn causes rotation of the crankshaft 120. The rotation of the eccentric shaft 112 of the crankshaft 120 causes the piston 131 to reciprocate in the cylinder 132. During the reciprocation of the piston 131 in the cylinder 132, as the piston 131 moves away from the valve plate 135, the suction valve reed opens the suction hole 136 and refrigerant is drawn into the cylinder 132 through the suction muffler 200. Later in the reciprocation cycle, as the piston 131 moves towards the valve plate 135, the suction valve reed closes the suction hole 136. The piston 131 compresses the refrigerant in the cylinder 132. As the pressure increases, the discharge valve reed opens the discharge hole 137 and the pressurized refrigerant enters the discharge chamber 139. The pressurized refrigerant is flows into the discharge tube 141 and to the refrigeration cycle via the discharge outlet 142. Refrigerant returned from the refrigeration cycle enters the shell of the reciprocating compressor 100 through the inlet pipe 143.

The suction muffler 200 will now be described in more detail with reference to FIG.2A and FIG.2B. FIG.2A is an isometric view of the suction muffler and FIG.2B shows the parts of the suction muffler.

As shown in FIG.2A, the suction muffler 200 is formed from an upper portion 210 and a lower portion 220. The upper portion 210 forms a muffler cover and has a connecting section 211 that extends upwards forms the suction port 201 which is an opening that
5 faces horizontally. As shown in FIG.1A, the suction port 201 fits over the suction hole 136 of the valve plate 135. A spring 212, which comprises two wing portions extending from a flat central portion, is attached to the opposite side of the connecting section 211 to the suction port 201. When the suction muffler 200 is incorporated into the reciprocating compressor 100, the spring 212 contacts the cylinder head 138 and
10 urges the suction port 201 over the suction hole in the valve plate 135. A suction muffler inlet 202 is provided on the lower portion 220. The suction muffler inlet 202 faces sideways. Two suction muffler legs 204 extend downwards from the lower portion 220. Oil holes are provided in the suction muffler legs 204 to allow oil to drain from the suction muffler 200.

15 As shown in FIG.2B, the upper portion 210 has a lip 213 around its lower edge which fits over a recess 221 around the top edge of the lower portion 220. A protrusion 214 which fits into a hole on the spring 212 is provided on the connecting section 211 of the upper portion 210. The interior of the lower portion 220 defines a muffling space
20 222. Refrigerant gas flowing from the suction muffler inlet 202 flows through the muffling space 222 before exiting the suction muffler 200 through the suction port 201.

The suction muffler 200 is formed from a polymer. The polymer may be a thermoplastic material such as polybutylene terephthalate (PBT) or polyphenylene
25 Sulfide (PPS).

During operation of the reciprocating compressor 100, the compressor body formed of the drive portion and the compression portion may move relative to the shell due to the vibrations caused by the reciprocating motion. Further, during transportation, the
30 compressor body may also move. This motion may result in impact between the suction muffler 200 and the shell of the reciprocating compressor. Such impact may result in deformation or damage to the suction muffler. Due to a general trend of miniaturization in the design of reciprocating compressors the size of the clearances between parts of the compressor body and compressor shell has reduced. This

potentially makes impacts between the suction muffler and the compressor shell more likely.

5 In embodiments of the present invention a damper or a plurality of dampers are provided on the suction muffler of a reciprocating compressor. The damper or dampers are arranged to absorb impact between the suction muffler and the shell of the reciprocating compressor.

10 FIG.3A to FIG.3C show a reciprocating compressor according to an embodiment of the present invention. FIG.3A is a cross sectional view, FIG.3B is an isometric view and FIG.3C is an isometric view without the shell. The reciprocating compressor 300 has a similar structure to the reciprocating compressor 100 shown in FIG.1A to FIG.1C. The reciprocating compressor 300 is a hermetic compressor which is hermetically sealed within a shell. The shell is formed from an upper shell portion and a lower shell
15 portion 301. The upper shell portion is not shown in FIG.3A or FIG.3B.

The reciprocating compressor 300 comprises a drive portion and a compression portion. The drive portion functions as an electric motor and comprises a rotor 311 and a stator 312. The rotor 311 is arranged within the stator 312. The rotor 311 is attached
20 to a crankshaft 320 which drives the compression portion. The crankshaft 320 comprises a main shaft portion 321 and an eccentric shaft portion 322. An electrical connection 313 is conductively coupled to windings of the stator 312 and/or the rotor 311.

25 The compression portion comprises a piston 331 which is arranged to reciprocate in a cylinder 332 formed in a cylinder block 333. The piston 331 is coupled to the eccentric shaft portion 322 of the crankshaft 320 by a connecting rod 334.

30 An upper section of the main shaft 321 of the crankshaft 320 is arranged within a main bearing 305 which supports the eccentric shaft portion 322 of the crankshaft 320. The main bearing 305 is coupled to the cylinder block 333. The main bearing 305 and the cylinder block 333 are supported by support legs 306 which rest on the stator 312. The stator 312 is supported above the base of the shell by four suspension springs 307.

A valve plate 335 is disposed at the end surface of the cylinder 332 that is distal from the crankshaft 320. The valve plate 335 has a suction hole 336 and a discharge hole 337. The suction hole 336 has a suction valve reed and the discharge hole 337 has a discharge valve reed. A cylinder head 338 is disposed over the valve plate 335. The
5 cylinder head 338 forms a discharge chamber 339 which is in fluid communication with the discharge hole 337. A suction muffler 400 has a suction port 401 arranged over the suction hole 336. The suction muffler 400 has a suction muffler inlet 402 which is in fluid communication with the interior of the shell of the reciprocating compressor 300. The suction muffler 400 comprises two dampers 430 which protrude from the
10 body of the suction muffler 400 towards the shell of the reciprocating compressor 300. The suction muffler 400 will be described in more detail below with reference to FIG.4A and FIG.4B.

The discharge chamber 339 of the cylinder head 338 is coupled to discharge muffler
15 340 which is joined to a discharge tube 341. The discharge tube 341 is coupled to a discharge outlet 342 which extends from the shell of the reciprocating compressor 300. The discharge outlet 342 is coupled to a refrigeration cycle. An inlet pipe 343 is coupled to the output of the refrigeration cycle and is connected to the interior of the shell. The interior of the shell of the reciprocating compressor 300 is filled with a
20 refrigerant gas.

The operation cycle of the reciprocating compressor 300 is as described above for the reciprocating compressor 100 shown in FIG.1A to FIG.1C. During operation, the dampers 430 on the suction muffler 400 may contact the lower shell portion 301 to
25 absorb impacts between the suction muffler 400 and the lower shell portion 301. It is noted that the dampers 430 are arranged on the suction muffler 400 to be closer to the lower shell portion 430 than the body of the suction muffler 400 thus the dampers 430 will impact the lower shell portion 301 before the body of the suction muffler 400. This means that the energy of any impact between the suction muffler 400 and the
30 lower shell portion 301 will be absorbed by the dampers 430.

The suction muffler 400 according to an embodiment of the present will now be described in more detail with reference to FIG.4A and FIG.4B. FIG.4A is an isometric view of the suction muffler 400 and FIG.4B shows the parts of the suction muffler 400.

As shown in FIG.4A, the suction muffler 400 is formed from an upper portion 410 and a lower portion 420. The upper portion 410 and the lower portion 420 together form a muffler body. The upper portion 410 forms a muffler cover and has a connecting section 411 that extends upwards and forms the suction port 401 which is an opening that faces horizontally. As shown in FIG.3A, the suction port 401 fits over the suction hole 336 of the valve plate 335. A spring 412, which comprises two wing portions extending from a flat central portion, is attached to the opposite side of the connecting section 411 to the suction port 401. When the suction muffler 200 is incorporated into the reciprocating compressor 300, the spring 412 contacts the cylinder head 138 and urges the suction port 401 over the suction hole in the valve plate 335. A suction muffler inlet 402 is provided on the lower portion 420. The muffler inlet 402 faces sideways. Two suction muffler legs 404 extend downwards from the lower portion 420. Oil holes are provided in the suction muffler legs 04 to allow oil to drain from the suction muffler 200. Two dampers 430 protrude from the surface of the lower portion 420 which faces the shell of the reciprocating compressor 300.

As shown in FIG.4B, the upper portion 410 has a lip 413 around its lower edge which fits over a recess 421 around the top edge of the lower portion 420. A protrusion 414 which fits into a hole on the spring 412 is provided on the connecting section 411 of the upper portion 410. The interior of the muffler body formed by the upper portion 410 and the lower portion 420 defines a muffling space 422. Refrigerant gas flowing from the suction muffler inlet 402 flows through the muffling space 422 before exiting the suction muffler 400 through the suction port 401.

As shown in FIG.4B, the two dampers 430 are approximately rectangular in cross section with the upper and lower edges being rounded. Each damper 430 has a protrusion 431 that is received into a corresponding hole 432 on the lower portion 410 of the suction muffler 400.

The dampers 430 may be formed from an elastomeric material such as nitrile butadiene rubber (NBR) or hydrogenated nitrile butadiene rubber (HNBR). As discussed above with reference to FIG.2A and FIG.2B, the body of the suction muffler

400 may be formed from a polymer. The polymer may be a thermoplastic material such as polybutylene terephthalate (PBT) or polyphenylene Sulfide (PPS).

5 Since the material of the dampers 430 is deformable, the dampers 430 may be held in place by a flange on the protrusions 431 which grips against the inner surface of the body of the suction muffler 400. The dampers 430 may also be welded or held in place with adhesive.

10 FIG.5A, FIG.5B and FIG.5C show a suction muffler according to an embodiment of the present invention. As shown in FIG.5A, the suction muffler 500 is formed from an upper portion 510 and a lower portion 520. The configuration of the upper portion 510 is as described above with reference to FIG.4A and FIG.4B. The upper portion 510 forms a muffler cover and has a connecting section 511 that extends upwards and forms a suction port 501. A spring 512 is attached to the opposite side of the
15 connecting section 511 to the suction port 501. In this embodiment, two dampers 530 which are circular in cross section protrude from the lower portion 520 of the suction muffler 500. As in the embodiment described above with reference to FIG.4A and FIG.4B, the lower portion 520 has a suction muffler inlet 502 which faces sideways. Two suction muffler legs 504 extend downwards from the lower portion 520. Oil holes
20 are provided in the suction muffler legs 504 to allow oil to drain from the suction muffler 500.

As shown in FIG.5B and FIG.5C, the dampers 530 are part of a damper insert 540 which is inserted into the lower portion 520 of the suction muffler 500. The damper
25 insert 540 has cylindrical protrusions 530 which pass through holes 532 in the lower portion 520 of the suction muffler 500. The damper insert 540 occupies part of the muffling space 522 within the muffler body and extends around the circumference of lower portion 520 of the suction muffler 500. The damper insert 540 may be formed from an elastomeric material such as nitrile butadiene rubber (NBR) or hydrogenated
30 nitrile butadiene rubber (HNBR).

FIG.6A, FIG.6B and FIG.6C show a suction muffler according to an embodiment of the present invention. The suction muffler 600 shown in FIG.6A, FIG.6B and FIG.6C has a plurality of dampers 630 which protrude from the exterior of the suction muffler

600 and which extend into a muffling space 622 within the body of the suction muffler 600.

As shown in FIG.6A, FIG.6B and FIG.6C, the plurality of dampers 630 comprises a
5 first damper 630a, a second damper 630b and a third damper 640c. Each of the
plurality of dampers 630 protrude approximately the same distance from the exterior
of the body of the suction muffler 600. The distances which the plurality of dampers
640 extend into the muffling space 622 varies. The first damper 630a extends a smaller
distance into the muffling space than the second damper 630b. The third damper
10 extends further into the muffling space 622 than the first damper 630a and the second
damper 630c.

As in the embodiments described above, the suction muffler 600 comprises an upper
portion 610 and a lower portion 620. The upper portion 610 forms a muffler cover and
15 has a connecting section 611 that extends upwards and forms a suction port 601. A
spring 612 is attached to the opposite side of the connecting section 611 to the suction
port 601. The lower portion 620 has a suction muffler inlet 602 which faces sideways.
Two suction muffler legs 604 extend downwards from the lower portion 620. Oil holes
are provided in the suction muffler legs 604 to allow oil to drain from the suction muffler
20 600. The upper portion 610 has a lip 613 around its lower edge which fits over a recess
621 around the top edge of the lower portion 620. A protrusion 614 which fits into a
hole on the spring 612 is provided on the connecting section 611 of the upper portion
610.

25 The lip 613 of the upper portion 610 has three notches 615 which fit over the dampers
630. Each of the dampers 630 has a slot 631 which receives the recess 621 around
the top edge of the lower portion. The dampers 630 may be formed from an
elastomeric material such as nitrile butadiene rubber (NBR) or hydrogenated nitrile
butadiene rubber (HNBR). The body of the suction muffler 600 may be formed from a
30 polymer. The polymer may be a thermoplastic material such as polybutylene
terephthalate (PBT) or polyphenylene Sulfide (PPS).

The interior of the muffler body formed by the upper portion 610 and the lower portion
620 defines a muffling space 622. Refrigerant gas flowing from the suction muffler inlet

602 flows through the muffling space 622 before exiting the suction muffler 600 through the suction port 601.

Since the dampers 630 have differing lengths which extend into the muffling space 622, each of the dampers 630 has a different natural frequency and will absorb vibrations at different frequencies. Therefore, noise reduction across different frequencies can be achieved.

FIG.7A and FIG.7B show a suction muffler according to an embodiment of the present invention. The suction muffler 700 has a damper 730 which is attached to the connecting section 711.

The suction muffler 700 comprises an upper portion 710 and a lower portion 720. The upper portion 710 forms a muffler cover and has a connecting section 711 that extends upwards and forms a suction port 701. In this embodiment, the damper 730 is attached to the connecting section 711. The damper 730 comprises an elongate portion 732 which runs parallel to the connecting section 711, and a rectangular section 734 which protrudes from the muffler body of the suction muffler 700.

The rectangular section 734 protrudes outwards from the suction muffler 700 further than the elongate portion 732 of the suction muffler 700.

The damper 730 may be formed from an elastomeric material such as nitrile butadiene rubber (NBR) or hydrogenated nitrile butadiene rubber (HNBR). The body of the suction muffler 700 may be formed from a polymer. The polymer may be a thermoplastic material such as polybutylene terephthalate (PBT) or polyphenylene Sulfide (PPS).

The lower portion 720 has a suction muffler inlet 702 which faces sideways. Two suction muffler legs 704 extend downwards from the lower portion 720. Oil holes are provided in the suction muffler legs 704 to allow oil to drain from the suction muffler 600. The upper portion 710 has a lip 713 around its lower edge which fits over a recess 721 around the top edge of the lower portion 720.

The damper 730 is attached to the connecting section 711 by a protrusion 714 which extends from the connecting section 711. The protrusion 714 is received within a hole 736 in the elongate portion 732 of the damper.

- 5 In this embodiment, the suction muffler 700 is not provided with a spring as in some of the embodiments described above, the elongate portion 732 of the damper 730 may perform the function of the spring. Thus this embodiment reduces the number of parts required for the suction muffler. The damper 730 also provides insulation between the suction muffler 700 and the cylinder head of the reciprocating compressor.

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FIG.8A, FIG.8B, FIG.8C and FIG.8D show a suction muffler according to an embodiment of the present invention. The suction muffler 800 has a damper 830 which is attached to the rear of the suction muffler 800. The damper 830 acts to prevent contact between the suction muffler 800 and the stator of the drive portion of the reciprocating compressor.

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The suction muffler 800 comprises an upper portion 810 and a lower portion 820. The upper portion 810 forms a muffler cover and has a connecting section 811 that extends upwards and forms a suction port 801. A spring 812 is attached to the opposite side of the connecting section 811 to the suction port 801. The lower portion 820 has a suction muffler inlet 802 which faces sideways. Two suction muffler legs 804 extend downwards from the lower portion 820. Oil holes are provided in the suction muffler legs 804 to allow oil to drain from the suction muffler 800. The upper portion 810 has a lip 813 around its lower edge which fits over a recess 621 around the top edge of the lower portion 820. A protrusion 814 which fits into a hole on the spring 812 is provided on the connecting section 811 of the upper portion 810.

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The damper 830 is approximately rectangular in shape and is attached to the rear of the lower portion 820. The damper 830 extends between the suction muffler legs 804. The damper 830 is attached to the lower portion 820 by two protrusions 832 which extend from the damper 830 and fit into holes 823 on the rear of the lower portion 820.

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The damper 830 may be formed from an elastomeric material such as nitrile butadiene rubber (NBR) or hydrogenated nitrile butadiene rubber (HNBR). The body of the

suction muffler 800 may be formed from a polymer. The polymer may be a thermoplastic material such as polybutylene terephthalate (PBT) or polyphenylene Sulfide (PPS).

- 5 In the embodiments described above, a damper or a plurality of dampers are provided on the suction muffler, the dampers protrude from the exterior of the suction muffler to absorb impacts with the shell or other parts of the reciprocating compressor. In some embodiments, the dampers also extend into a muffling space within the suction muffler and may attenuate noise within the flow of refrigerant gas in the suction muffler. It will
10 be appreciated that a combination of the dampers described herein may be provided on a suction muffler.

It is noted that in some of the embodiments described above, the dampers are arranged on the suction muffler to absorb impacts between the suction muffler and the
15 lower shell portion. However, embodiments with different arrangements of the upper and lower shell portions are envisaged and the dampers may be arranged to absorb impacts between the suction muffler and the upper shell portion.

Whilst the foregoing description has described exemplary embodiments, it will be
20 understood by those skilled in the art that many variations of the embodiments can be made within the scope and spirit of the present invention.

CLAIMS

1. A suction muffler for a reciprocating compressor, the suction muffler comprising:
 - a muffler body; and
 - a damper protruding from the muffler body.
2. A suction muffler according to claim 1, wherein the damper extends into a muffling space within the muffler body.
3. A suction muffler according to claim 2, wherein the damper extends radially into the muffling space.
4. A suction muffler according to claim 3, comprising a plurality of dampers protruding from the muffler body and wherein each damper of the plurality of dampers extends radially by a different length into the muffling space within the muffler body.
5. A suction muffler according to claim 2, wherein the damper extends circumferentially around the muffling space.
6. A suction muffler according to claim 5, wherein the damper extends from a muffler insert provided in a muffling space within the muffler body.
7. A suction muffler according to any preceding claim wherein the damper protrudes from the muffler body of the suction muffler by at least 2mm.
8. A suction muffler according to any preceding claim wherein the damper protrudes from the muffler body of the suction muffler by less than 5mm.
9. A suction muffler according to any preceding claim, wherein the damper and muffler body are formed from different materials.
10. A suction muffler according to claim 9, wherein the damper is formed from a material that is softer than the muffler body.

11. A suction muffler according to any preceding claim wherein the damper is formed from an elastomeric material.
12. A suction muffler according to claim 11 wherein the elastomeric material is butadiene rubber (NBR) or hydrogenated nitrile butadiene rubber (HNBR).
13. A reciprocating compressor comprising:
 - a hermetically sealed shell;
 - a drive unit and a compression unit arranged within the hermetically sealed shell, the compression unit being configured to draw in and compress a refrigerant from within the hermetically sealed shell and the drive unit being configured to drive the compression unit; and
 - a suction muffler provided on an inlet of the compression unit, the suction muffler comprising a muffler body; and a damper protruding from the muffler body.
14. A reciprocating compressor according to claim 13, wherein the damper extends into a muffling space within the muffler body.
15. A reciprocating compressor according to claim 14, wherein the damper extends radially into the muffling space.
16. A reciprocating compressor according to claim 15, the suction muffler comprising a plurality of dampers protruding from the muffler body and wherein each damper of the plurality of dampers extends radially by a different length into the muffling space within the muffler body.
17. A reciprocating compressor according to claim 14, wherein the damper extends circumferentially around the muffling space.
18. A reciprocating compressor according to claim 17, wherein the damper extends from a muffler insert provided in a muffling space within the muffler body.

19. A reciprocating compressor according to any one of claims 13 to 18, wherein the damper protrudes from the body of the suction muffler by at least 2mm.
20. A reciprocating compressor according to any one of claims 13 to 19, wherein the damper protrudes from the body of the suction muffler by less than 5mm.
21. A reciprocating compressor according to any one of claims 13 to 20, wherein the damper and muffler body are formed from different materials.
22. A reciprocating compressor according to any one of claims 13 to 20, wherein the damper is formed from a material that is softer than the muffler body.
23. A reciprocating compressor according to any one of claims 13 to 22, wherein the damper is formed from an elastomeric material.
24. A reciprocating compressor according to claim 23, wherein the elastomeric material is butadiene rubber (NBR) or hydrogenated nitrile butadiene rubber (HNBR).