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MUFFLER FOR REFRIGERATOR COMPRESSOR AND COMPRISING U-SHAPED MEMBERS

Filed Nov. 21, 1963

FIG. 1.

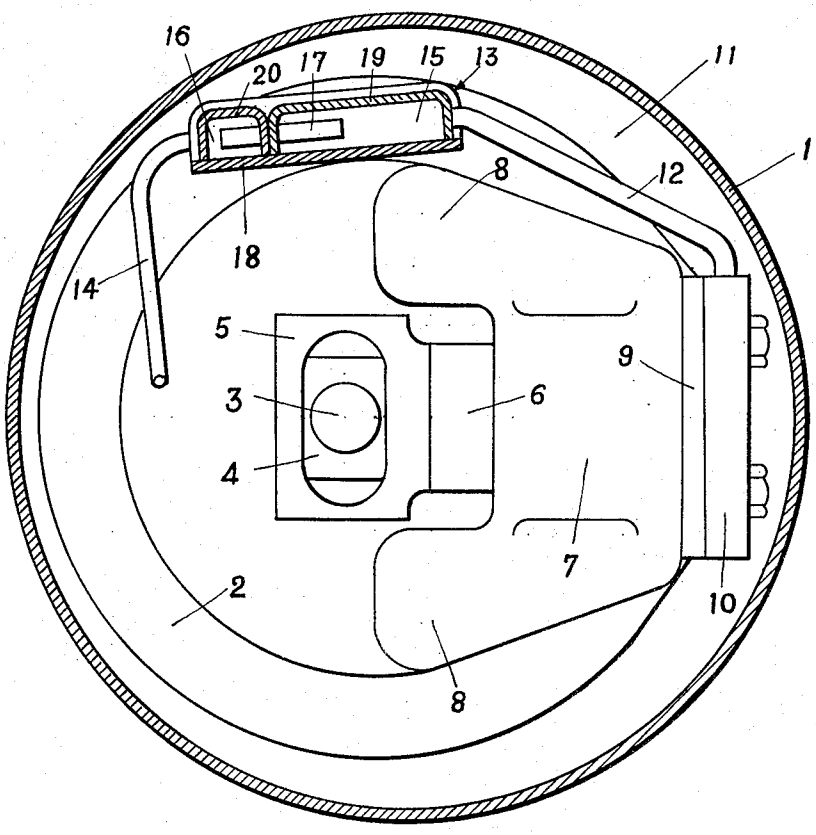


FIG. 2.

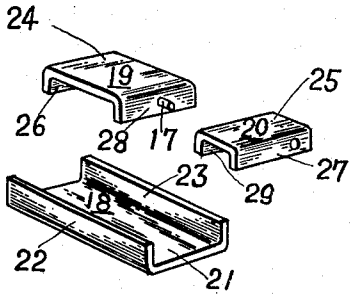
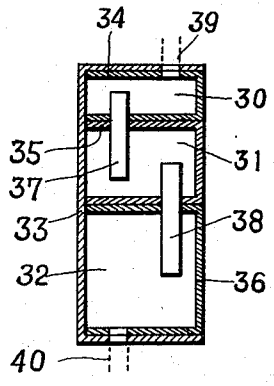


FIG. 3.



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MUFFLER FOR REFRIGERATOR COMPRESSOR AND COMPRISING U-SHAPED MEMBERS

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8 Claims. (Cl. 181—53)

The present invention relates to acoustical mufflers or silencers and particularly to mufflers used in small sealed refrigerating units.

It is known to manufacture mufflers of preformed sheet metal parts so that a muffler chamber is enclosed by only two parts. For this purpose, it has been necessary heretofore to preform the parts by deep drawing or stamping. These procedures require relatively thin sheets, which are undesirable since they may become self-vibrating in use. Moreover, very expensive dies are necessary for forming the parts. In the case of deep drawing, each of the sheets must be operated on several times in successive drawing operations and the size of the chambers that can be produced is limited. Moreover, there is no free choice with respect to the location of the connecting seams between the parts. In order to divide the required depth of draw between the two parts, the connecting seams are located midway between the top and bottom of the chamber and hence extend across the middle of the four peripheral walls of the chamber. This is a disadvantage, because of the space limitations within the sealed chamber, it is desirable to use small mufflers with inlet and outlet lines placed in the peripheral walls. Such location is, however, difficult because of the seams joining the two parts of the muffler.

These disadvantages are overcome by the present invention in accordance with which the muffler chambers are formed solely of sheet metal members of U-shaped cross-section with a central panel portion and opposite flange portions projecting approximately perpendicularly at two opposite sides of the panel portion. Two of the U-shaped sheet metal members fit together so as to provide a closed chamber having opposite walls formed by the panel portions of the respective members and peripheral side walls formed by the flange portions. To provide a muffler having two adjacent chambers, two smaller U-shaped sheet metal members are nested beside one another in a larger U-shaped member having a width between its flanges equal to the length of the smaller members and a length equal to the combined width of the smaller U-shaped members. Additional muffler chambers can readily be provided by using a number of smaller U-shaped members equal to the desired number of chambers and a single larger U-shaped member of a size to receive the smaller members. Since formation of the U-shaped members from sheet material requires only a bending of the sheet to form the two flange portions, it will be seen that relatively simple tools or dies may be used and the production costs are considerably less than for parts requiring a deep drawing operation. Moreover, the bending operation permits the use of relatively thick sheets so as to produce a sound silencer which is more rigid and resistant to self-vibration. A further advantage of the construction in accordance with the invention is that the seams between the members run along the corner edges, leaving all of the faces free of seams. Hence, inlet and outlet connections for the chambers can be placed anywhere desired, including the narrow side faces.

Preferably the inlet and outlet openings for each muffler chamber are in the opposite flange portions of the same U-shaped sheet. The openings for each chamber can thus

be provided by a stamping operation on one sheet only. The connection between two adjacent muffler chambers is preferably made by means of a tube section which extends through aligned openings of the two adjacent sides of the U-shaped sheets of the adjacent chambers. These tube sections can be relatively long in view of the fact that they run parallel to the larger walls of the chambers. This increases the silencing effect of the muffler.

In this connection, it is particularly advantageous if the inlet and outlet openings in each U-shaped sheet are offset relative to one another. The tube section between two chambers can then extend almost the entire width of both chambers since the inlet and outlet tubes for each chamber are offset and do not interfere with one another.

The construction in accordance with the invention also permits the assembling and uniting of the several U-shaped members in a simple and economical manner. Preferably, the U-shaped sheets after being nested together are clamped in place and then all of the parts, preferably including the connecting tubes, are bonded together by being placed in a copper soldering furnace. The parts can temporarily be held together in a convenient manner by spot welding at one or two points. A tight connection between all of the parts is then accomplished by dipping the assembly in molten copper. The liquid copper penetrates the capillary spaces between the several parts and forms a tight connecting seam. The construction is such that not only the joints located at the surface are filled, but also the joints in the interior casing which are more difficult to reach. This is accomplished by the fact that the liquid copper is led inwardly by the capillary space between the adjoining flange portions of adjacent U-shaped sheets. Moreover, the treatment in the copper soldering furnace has the further advantage of relieving stresses in sheets and cleaning and rust-proofing the sheets.

Other features and characteristics of the invention will appear more fully from the following description of two embodiments of the invention shown by way of example in the accompanying drawing in which,

FIG. 1 is a schematic horizontal section through a small sealed refrigerating unit with a muffler in accordance with the invention used in the pressure line,

FIG. 2 is an exploded perspective view showing the several parts of the muffler of FIG. 1, and

FIG. 3 is a longitudinal section of another embodiment.

As illustrated in FIG. 1, a motor compressor unit sealed in the casing 1 comprises a motor, not shown, having on a motor shaft thereof a crankpin 3 which is received in a slide ring 4 of a yoke 5 on the piston 6 of a compressor cylinder 7. Rotation of the motor thus reciprocates the piston in the cylinder. Hollow wing portions 8 on opposite sides of the cylinder 7 constitute suction mufflers of the compressor. The head of the cylinder is closed by a valve plate 9 having inlet and outlet valves and a valve cover 10.

The inner space 11 of the casing 1 is connected through the intake muffler chambers in wing portions 8 with the suction side of the compressor. The refrigerant gas is drawn through the suction muffler chambers into the cylinder 7 where it is compressed and discharged through the pressure tube 12. This tube leads to a muffler 13, the outlet of which is connected with a longer pressure tube 14 which leads to an outlet connection extending through the wall of the casing 1, which in turn is connected with the usual condenser, not shown.

The muffler 13 has two chambers 15 and 16 connected with one another through a tube section 17. As shown in FIG. 2, the muffler is made by joining three preformed U-shaped sheet metal members 18, 19 and 20. The U-shaped member 18 is substantially rectangular and comprises a central panel portion 21 and two opposite flange

portions 22 and 23 extending along the longitudinal edges of the sheet and projecting approximately perpendicular to the panel portion. The depth of the member 18 as defined by the flanges 22 and 23 is less than the width and the width is in turn, less than the length.

The other two U-shaped members 19 and 20 are also rectangular and each has a length equal to the width of member 18 as measured between the flanges 22 and 23. The combined width of the two U-shaped members 19 and 20 is equal to the length of member 18. The two members 19 and 20 are preferably of different width in order to provide muffler chambers of different volume. Member 19 has a central panel portion 24 with opposite flange portions 26 and 28 while member 20 has a central panel portion 25 with opposite flange portions 27 and 29. The depth of the flanges is substantially equal to that of flanges 22 and 23 of the U-shaped member 18.

The three U-shaped sheet metal members 18, 19 and 20 are assembled as shown in FIG. 1, to form the muffler chambers 15 and 16. The opposite major walls of chamber 15 are formed by the panel portion 21 of member 18 and panel portion 24 of member 19 while the peripheral side walls are formed by flange portions 22, 23, 26 and 28. Similarly, opposite walls of chamber 16 are formed by panel portion 21 of member 18 and panel portion 25 of member 20 while peripheral side walls are formed by flange portions 22, 23, 27 and 29. Flange portions 28 and 29 of members 19 and 20 are contiguous to one another and form the partition between the two chambers 15 and 16.

Aligned holes in flanges 28 and 29 receive the tube section 17 which connects the two chambers 15 and 16. Since this tube section extends parallel to the major faces of the chambers, it can be quite long, extending if desired, almost the full width of the chambers, leaving only enough room to provide free passage of refrigerant gas through the connecting tube. Flange portions 26 and 27 of members 19 and 20 are likewise provided with holes for connection of pressure tubes 12 and 14. These holes are preferably offset with respect to the holes receiving the tube section 17.

The assembled parts of the muffler are clamped or secured together, for example by spot welding. It is sufficient merely to tack each of the transverse members 19 and 20 to the longitudinal member 18 at one or two points. When this assembly is placed in a soldering oven, the liquid material for example copper, penetrates by capillary action into all the joints between the several parts. It is of particular importance that this action occurs not only on the seams following the outer edges of the U-shaped sheet 18, but also between the contiguous flange portions 28 and 29 and between the edges of flanges 28 and 29 and the contiguous portion of the panel portion 21 of member 18. The liquid soldering material likewise is led by capillary action into the joint between the tube section 17 and the edges of the holes in flange portions 28 and 29 through which the tube 17 passes. The soldering material, on hardening, thus not only unites the parts into an integral whole, but also provides a fluid-tight sealing of all of the joints. Moreover, the surface of the mufflers is cleaned and left coated with a layer of copper or other soldering material as rust-proofing protection.

A muffler in accordance with the present invention can be provided with any desired number of chambers depending on the number of transverse U-shaped members used. In FIG. 3, there is illustrated a muffler having three chambers 30, 31 and 32. This muffler comprises a longitudinal U-shaped sheet member 33 and three transverse U-shaped sheet members 34, 35 and 36. While all of the transverse U-shaped sheets 34, 35 and 36 are of the same length so as to fit between the opposite flanges of the longitudinal U-shaped member 33, they are of different widths in order to provide chambers of

different volumes. The length of the longitudinal member 33 is substantially equal to the sum of the widths of the transverse U-shaped members 34, 35 and 36.

The chambers communicate with one another through tube sections 37 and 38 extending through openings provided in the contiguous flange portions of adjacent U-shaped members. Openings are also provided in the flange portions forming the outer ends of the end chambers for connection of outlet and inlet pressure lines 39 and 40. The openings are formed only in the flange portions of the transverse U-shaped members 34, 35 and 36, none being required in the longitudinal U-shaped member 33. Since the openings in the opposite flange portions of each of the transverse U-shaped members are offset relative to one another, the connecting tubes 37 and 38 are correspondingly offset and can hence extend more than half way across the chambers without interfering with one another. The greater length of connecting tubes thus provided, affords greater sound attenuation. The parts of the muffler shown in FIG. 3 are assembled and bonded together in the same manner as described above with respect to FIGS. 1 and 2,

While two examples of mufflers in accordance with the present invention have been shown by way of example, it will be understood that the invention is in no way limited to these embodiments. Modifications within the scope of the invention will be apparent to those skilled in the art. For example, instead of being rectangular, the U-shaped sheets may be trapezoidal or other desired shape to meet particular acoustical or space requirements. Still other changes in details of construction may be made without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. An acoustical muffler comprising a first sheet metal member of U-shaped cross-section forming a panel portion and flange portions projecting approximately perpendicularly at two opposite sides of said panel portion and at least two additional sheet metal members of U-shaped cross-section each forming a panel portion and flange portions projecting approximately perpendicularly at two opposite sides of said panel portion, the length of each of said additional members being substantially equal to the width of said first member between its said flange portions and the combined width of said additional members being approximately equal to the length of said first member, said additional members being nested beside one another in said first member with said additional members reversed relative to said first member and extending transversely thereof to form a plurality of chambers, each having opposite walls formed by said panel portions of said first member and said additional members respectively and side formed by said flange portions of said first and additional members, and means providing communication with said chambers.

2. A muffler according to claim 1, in which said communication is provided by holes in said flange portions of said members.

3. A muffler according to claim 1, in which said communication is provided by holes in the flange portions of said additional members, each chamber having an inlet and an outlet offset relative to one another.

4. A muffler according to claim 3, in which tubes extend through said holes and project more than half way across the respective chambers.

5. An acoustical muffler comprising a first rectangular sheet metal member of U-shaped cross-section forming a panel portion and flange portions projecting approximately perpendicularly at two opposite sides of said panel, said member being of greater length in a direction longitudinal of said flange portions than width between said flange portions and being of greater width than depth in a direction perpendicular to said panel portion and at least two additional rectangular sheet metal members of U-shaped cross-section each forming a panel portion

and flange portions at two opposite sides of said panel portion, the depth of said additional members being substantially equal to that of said first member, the length of each of said additional members being substantially equal to the width of said first member between its flange portions and the combined width of said additional members being approximately equal to the length of said first member, said additional members being nested beside one another in said first member with said additional members reversed relative to said first member and extending transversely thereof to form a plurality of chambers each having opposite walls formed by said panel portions of said first member and additional members respectively and sides formed by said flange portions of said first and additional members, said flange portions having holes therein to provide inlet and outlet passages for each of said chambers.

6. A muffler according to claim 5, in which said holes are in the flange portions of said additional members and the inlet and outlet passages of each chamber are offset relative to one another.

7. A muffler according to claim 6, in which tubes extend through and fit tightly in said holes and project into said chambers a distance more than half way across said chambers.

8. A muffler according to claim 5, in which said additional members are of different width to form chambers of different volume.

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LEO SMILOW, *Examiner.*