

[54] **NOISE REDUCTION MEANS FOR
CONNECTING REFRIGERANT
COMPRESSORS IN AIR CONDITIONERS**

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417/312, 313, 363

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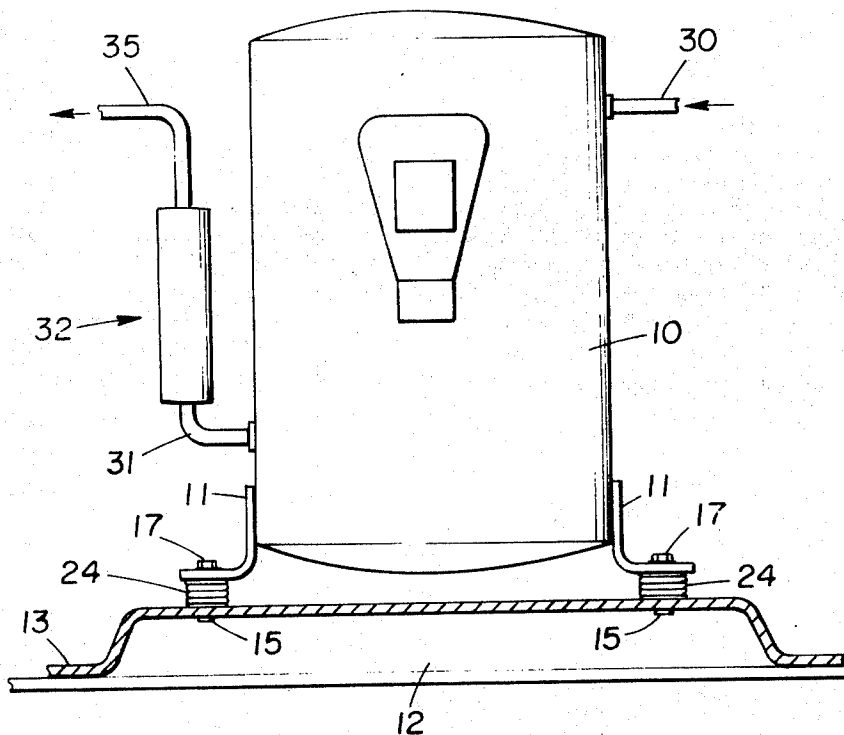
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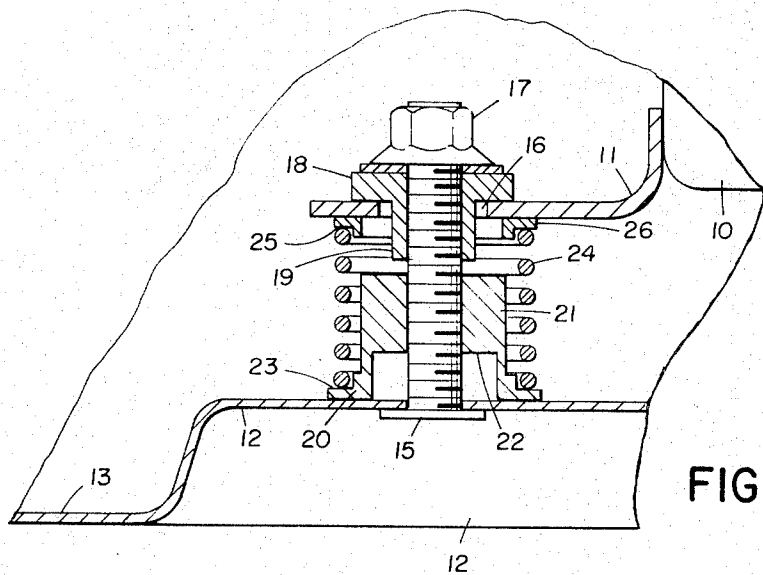
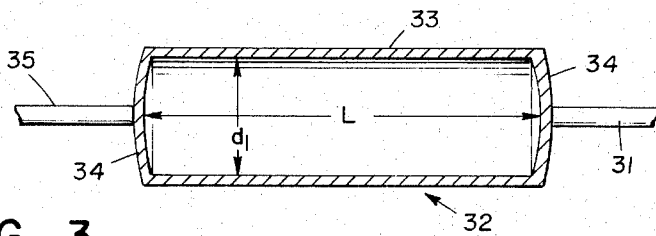
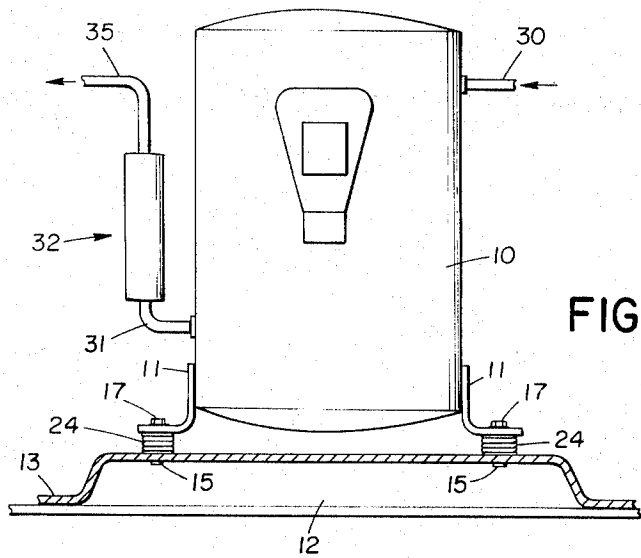
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ABSTRACT

A refrigerant compressor in an air conditioning unit is connected to the base pan of the unit and to the refrigerant system to reduce transmission of compressor vibration to the base pan and to attenuate the dominant sound wave in the refrigerant lines produced by the pulsating refrigerant. The means employed include coil springs and elastomeric mounts for the compressor to the base pan and a hollow cylinder connected to the compressor's outlet.

6 Claims, 3 Drawing Figures





NOISE REDUCTION MEANS FOR CONNECTING REFRIGERANT COMPRESSORS IN AIR CONDITIONERS

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of application Ser. No. 181,858, filed Sept. 20, 1971.

BACKGROUND OF THE INVENTION

Refrigerant compressors, especially of the reciprocating variety, produce considerable mechanical vibration and, in addition, the pulsating, compressed refrigerant sets up a sound wave in the refrigerant system. If these vibrations and sound waves are transmitted through the base pan and the refrigerant system, whereby the entire air conditioning unit is affected, the operating noise level is greatly increased. As silent a unit as possible is of course the most desirable aim in any air conditioning unit, especially of the window or room type, and it is the principal object of the present invention to connect the compressor to the unit in a manner which contributes to this aim.

SUMMARY OF THE INVENTION

The foregoing object is achieved by connecting each of the mounting feet, with which compressors of the type concerned are usually equipped, to the base pan through a supporting coil spring and a pair of elastomeric bushings so that there is no contact between the feet and the base pan except through the bushings. The feet in effect sit floatingly on the springs, which are insulated from the base pan by means of the bushing, and a bolt axially through each spring and its pair of bushings limits the extent of upward movement of the compressor, the bolts also being insulated from the compressor by the bushings. To the refrigerant outlet of the compressor is connected in turn one end of an attenuator which is in effect a hollow cylinder to whose other end is connected the refrigerant output line to the condenser. The attenuator is sized by well known principles to damp the dominant frequency of the sound wave produced in the pulsating refrigerant emitted from the compressor.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a typical air conditioner refrigerant compressor illustrating its connection to the base pan and the refrigerant output line of an air conditioner according to the invention.

FIG. 2 is an enlarged detail view in section illustrating the manner in which the compressor's feet are connected to and supported above the base pan.

FIG. 3 is an enlarged view of the hollow attenuator, taken in section along its axis.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the drawings, a typical refrigerant compressor 10 for an air conditioner is equipped with several laterally extending feet 11 which are supported above and connected to an upset compressor platform 12 formed in an air conditioner base pan 13 by assemblies which mechanically insulate the compressor 10 from the base pan 13 and at the same time permit it to float relative thereto. As illustrated particularly in FIG. 2, each of these assemblies consists of a headed bolt 15, its head fixed below the platform 12, extending up

through the latter and an enlarged hole 16 in a compressor foot 11, being fitted with an integral washer-nut 17 at its upper end. Between the latter and the upper face of the foot 11 is an elastomeric bushing 18 around and frictionally engaging the bolt 15 and having a depending sleeve portion 19 fitting down through the hole 16 in spaced concentric relation thereto. Below the bushing 18 a second elastomeric bushing 20 sits on the upper face of the compressor platform 12 and is provided with an upper sleeve portion 21 which also surrounds and frictionally engages the bolt 15 and is spaced below the sleeve 19. The portion of bushing 20 below its sleeve 21 is provided with a counterwell 22 and is also radially enlarged and stepped to form a seat 23 for locating and receiving the lower end of a compressible coil spring 24 which spacedly encompasses the sleeves 19 and 21. The upper end of the spring 24 bears against an annular seat 25 on the lower face of a fibrous washer 26 whose upper face in turn bears against the lower face of the foot 11, the washer 26 also spacedly encompassing the sleeve 19 of the bushing 18.

Hence, as will be evident, the feet 11 and thus the compressor 10 float on the springs 24 without interference from the bushings 18 and 20 which remain fixed on the bolts 15. The enlarged holes 16 in the feet 11 and the spaced relation of the fibrous washers 26 relative to the sleeves 19 of the bushings 18 accommodate lateral movement of the compressor 10 without interference from the bushings 18 or the springs 24 since the upper faces of the washers 26 are laterally movable relative to the feet 11. The latter in turn are effectively mechanically insulated from the bolts 15 and the base pan 13 by the bushings 18, and the springs 24 from the pan 13 by the lower ends of the bushings 20 on which the springs 24 sit. The washer-nuts 17 merely limit the amount of upward movement of the feet 11 and hold the assemblies together.

The refrigerant inlet of the compressor is indicated at 30 and the refrigerant outlet at 31. To the latter is connected the attenuator 32 which is a hollow cylinder 33 (though it need not necessarily be cylindrical) with end walls 34 through which the refrigerant outlet 31 and the refrigerant output line 35 to the condenser (not shown) communicate. The interior length in feet of the attenuator 32 is denoted by L ; its inner diameter by d_1 and that of the refrigerant lines 31 and 35 by d_2 . In order to determine the proper length L , the dominant frequency f in cycles/sec. of the sound waves produced in the pulsating refrigerant emitted from the compressor 10 is first ascertained by well known methods, as is the velocity v in ft./sec. of sound through the refrigerant itself. The length L is then determined from the formula $L = v/4f$. The greater the ratio of d_1 to d_2 the better the results tend to be and in practice about 5 to 1 has given very satisfactory results using an attenuator with a 1 1/2 inches I.D. and refrigerant lines of 5/16 inches I.D. Connecting the compressor 10 to the base pan 13 by the means previously described and to the refrigerant system by means of the attenuator 32 results in dramatic reduction of the noise level in air conditioners of the kind concerned.

Though the present invention has been described in terms of a particular embodiment, being the best mode known of carrying out the invention, it is not limited to that embodiment alone. Instead, the following claims are to be read as encompassing all modifications and

adaptations of the invention falling within its spirit and scope.

I claim:

1. In an air conditioner having a base pan, a refrigerant output line and a compressor producing a pulsating emission of refrigerant resulting in a sound wave of a dominant frequency f and of a velocity v in said refrigerant, said compressor including a refrigerant outlet and a plurality of laterally extending feet for supporting said compressor in spaced relation above said base pan, the combination therewith of silencing means for connecting said compressor to said refrigerant line and base pan comprising: a hollow attenuator having a pair of opposite end walls, the distance between said end walls defining the length L of said attenuator, said compressor outlet and refrigerant output line communicating with the interior of said attenuator through respective ones of said end walls, wherein $L = v/4f$; and, in conjunction with each of said feet, a resilient mounting assembly including annular upper and lower elastomeric portions, said upper portion overlying the top of said foot and extending down therethrough, said lower portion being disposed beneath said foot and engaging the top of said base pan, a rigid fastener having a lower end anchoring said fastener against upward movement relative to said base pan, said fastener extending upwardly from said base pan and axially through and in frictional engagement with said upper and lower portions, the upper end of said fastener overlying said upper portion all effective to limit upward movement of said foot.

2. The combination of claim 1 wherein said attenua-

tor end walls are joined by a cylindrical wall to form said attenuator, the interior diameter of said cylindrical wall being greater than the interior diameter of said refrigerant outlet and output line.

3. The combination of claim 2 wherein the ratio of the interior diameter of said cylindrical wall to the interior diameters of each of said refrigerant outlet and output line is about 5 to 1.

4. The combination of claim 1 wherein said upper and lower portions comprise two separate members axially spaced from each other, said upper member having an annular portion below said foot and said lower member an annular portion above said base pan, and including a compressible coil spring concentric with said members and spacedly encompassing said annular portions thereof, said spring having a lower end engaging and supported only upon said lower member and an upper end below and supporting said foot.

5. The combination of claim 4 including an annular fibrous member disposed between and engaging the upper end of said spring and a lower face of said foot in spaced encompassing relation to said upper annular portion and said fastener, said fibrous member being laterally movable relative to said foot, and wherein said fastener comprises a bolt having a head engaging a lower face of said base pan and a nut engaging an upper face of said upper member.

6. The combination of claim 5 wherein said lower and fibrous members each includes a seat portion receiving and locating the respective ends of said spring against lateral movement relative thereto.

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