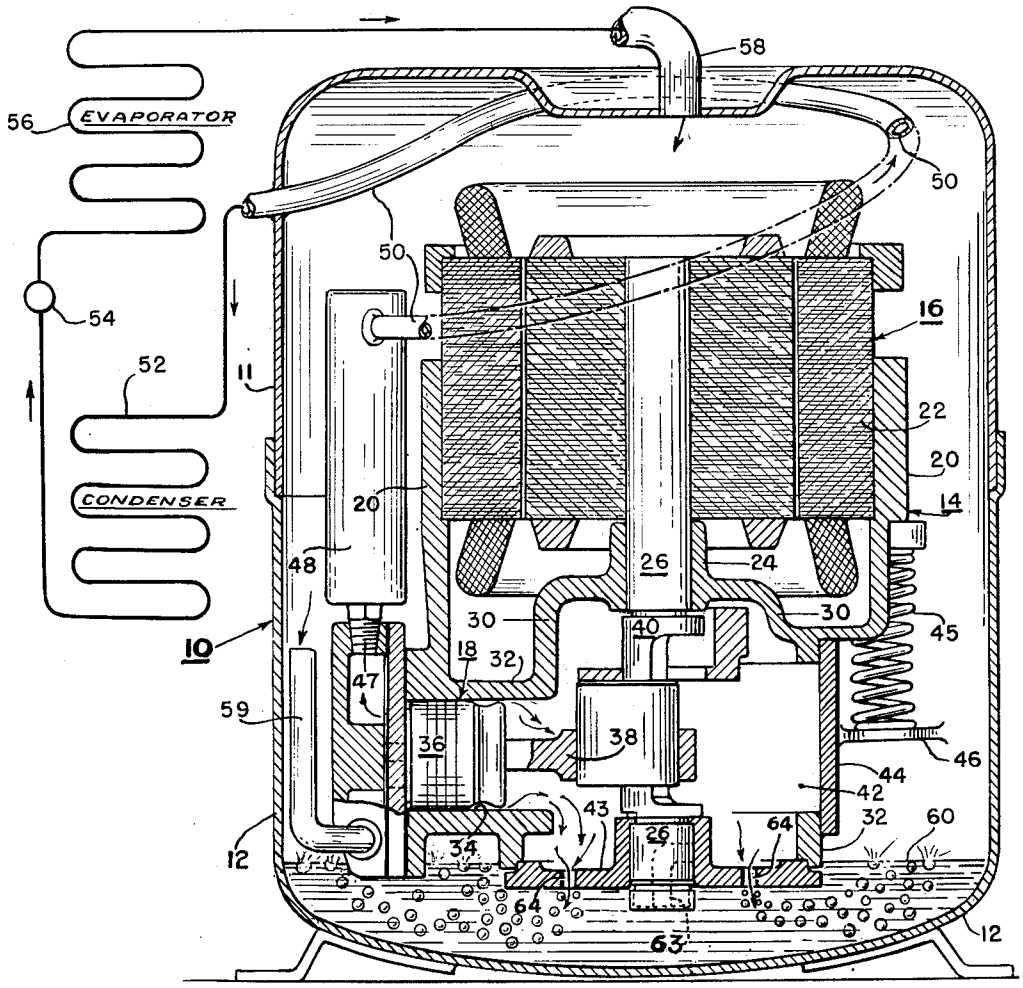
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MOTOR COMPRESSOR UNIT WITH REDUCED NOISE TRANSMISSION

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WITNESSES

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# MOTOR COMPRESSOR UNIT WITH REDUCED NOISE TRANSMISSION

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This invention relates to refrigeration apparatus and more particularly to the compressors in refrigeration units.

In constructing a refrigeration unit is is desirable to provide means for minimizing compressor operating noise attributable to compressor vibrations being conducted through a body of lubricating oil to the shell or case which encloses the compressor. In this type of compressor the oil body acts as a sound transmitting medium and the case transduces the sound wave energy into audible, disturbing noises.

In the past, various arrangements have been proposed to reduce the ability of the oil body to transmit sound. For example, the copending application of Richard T. Douglas, Serial No. 739,316, filed June 2, 1958, now abandoned, and assigned to the assignee of the present invention, deals with the same problem, and solves it by conducting suction gas through a tube into the oil body. The bubbling of gas through the oil body provides hundreds of air pockets therein which insulate the disturbance from the sound transducer. The present invention copes with the same problem but it is believed to solve it more satisfactorily, since fewer parts are required and a more compact arrangement within the case is possible.

According to the present invention, the compressor includes a block in which is provided a crankcase and at least one cylinder. A piston is slidably fitted within the cylinder and is adapted to receive reciprocating forces so that it will slide back and forth therein to compress gas on the forward stroke and to create suction on the return stroke. The fit between the piston and the cylinder walls is such that a portion of the compressed gas will bypass the piston on the compression stroke and enter the crankcase which, unlike conventional constructions, is closed to the crankcase except for one or more openings which extend into the oil body. With this arrangement the gas bypassed on the compression stroke is discharged into the oil body and it bubbles therethrough, eventually being returned to the compression chamber for recompression. The bubbling of the bypass gas through the oil body aerates the oil and provides it with insulation properties, thereby reducing its ability to transmit sound. Furthermore, the oil body absorbs acoustic energy and reduces reverberations. As a result the compressor is quieter running than prior constructions.

The various objects, features and advantages of the invention will appear more fully from the following detailed description and claims taken in connection with the accompanying drawing, forming part of this application, and wherein:

The single FIGURE of the drawing is a vertical, sectional and partially schematic view of refrigeration apparatus embodying the invention.

The invention, as shown in the drawing, is applied to a hermetic or sealed refrigeration compressor comprising a two-part case 10 having upper and lower pressed sheet metal sections 11 and 12, in which is disposed a main casting 14 for mounting an electric driving motor 16, and a compressor generally designated by the numeral 18. The main casting 14 includes an upstanding annular flange 20 into which is pressed the stator 22 of the motor 16, and a central upright bearing boss 24. The latter receives a drive shaft 26, to the upper end of which is secured the motor rotor 28.



The annular flange 20 and bearing boss 24 are interconnected by an annular web 30 from which depends a cylinder block 32 for the compressor 18. The block 32 is formed with a radially extending cylinder 34 adapted to receive a reciprocable piston 36. The piston 36 slides back and forth in the cylinder 34 in response to reciprocating forces received through a connecting rod 38 from a crank 40 formed on the lower end of the drive shaft 26.

The cylinder block 32 is made hollow adjacent the cylinder 34 to provide there a crankcase 42 in which the connecting rod 38 and crank 40 may be accommodated. An opening in the lower end of the block 32 is closed by a plate 43 in which is journalled the lower end of shaft 26. In addition, an access opening in block 32 to the interior of the crankcase 42 is closed by a cover 44.

The compressor assembly 18 is resiliently supported, to preclude noise, by means of helical compression springs 45, preferably, three, each connected between the annular flange 20 and an inwardly extending supporting member 46 carried by the lower case section 12.

Refrigerant leaves the compressor cylinder 34 through an outlet 47, passes through a muffler 48, and is conducted by a discharge conduit 50 to a condenser 52 outside the case 10. Condensed refrigerant is expanded through expansion means 54 and boiled off in an evaporator 56, after which it is returned to the interior of the case 10 by a suction line 58. After entering the case 10, refrigerant is returned to the cylinder 34 through an inlet tube 59 after it has passed around the motor 16.

The bottom of the lower case section 12 holds a body or pool of lubricating oil in which is submerged the lower end of the cylinder block 32 and the end plate 43. Also submerged in the oil pool 60 is a duct 63 communicating with a network of passageways of a forced feed lubrication system which is neither shown nor described in detail, since it is of conventional construction and forms no significant part of the present invention.

Sound wave energy is transmitted partly by the oil pool 60 from the vibrating compressor 18 to the case 10, and there transduced into disturbing noises which emanate from the case 10. It is the principal concern of the present invention to reduce this noise.

The construction of the compressor, as thus far described, is unique for compressors of the type which receive suction gas directly into the case for use in cooling the motor on its way to the compressor chamber. Ordinarily, in this type of compressor, the crankcase 42 is open to the interior of the case 10 simply to reduce the weight of the cylinder block 32, and because no use has been made heretofore of gas blown by the piston 36 during the compression stroke. The present arrangement closes the access opening to the crankcase 42 by the cover 44 and provides, in addition, one or more openings or passageways 64 through plate 43 at the lower end of the cylinder block 32. Openings 64 therefore provide communication between the crankcase 42 and that portion of the oil pool 60 directly beneath the compressor 18; and it is through these openings 64 that bypass gas is discharged from the crankcase and bubbled through the oil pool to the surface thereof, where a froth or foam is formed.

Refrigerant within the crankcase 42 is at a higher pressure than the suction gas circulating inside the case 10 so that flow from the crankcase through the oil pool 60 to the circulating suction gas is promoted. This provision aerates the oil pool 60 and produces a large number of air pockets in the oil pool which reduce its ability to transmit sound wave energy. Additionally, the oil pool 60 reduces reverberations by absorbing acoustic energy.

Compressors constructed according to this invention have been found to run appreciably quieter than those constructed according to the prior art.

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof.

What is claimed is:

1. In refrigeration apparatus, a hermetic case, a liquid body in said case, a compressor resiliently mounted within said case in spaced relation thereto, said compressor having a portion submerged in said liquid body, said compressor including a closed crankcase, at least one cylinder communicating with said crankcase, and a reciprocable piston slidably fitted within said cylinder to provide a compression chamber, said piston compressing the gas in said chamber on moving in one direction and providing suction in said chamber on moving in the other direction, means providing at least one passageway establishing communication between said crankcase and said liquid body adjacent the submerged portion of said compressor, the fit between said piston and said cylinder permitting some compressed gas to bypass said piston to said crankcase, the gas being forced out said passageway and through said liquid body during operation of said piston, whereby foaming of said liquid body is effected and the ability of said liquid body to transmit sound wave energy is reduced.

2. In refrigeration apparatus, a gas containing shell, a body of liquid in said shell, a resiliently mounted compressor disposed within said shell in spaced relation thereto and partly submerged in said liquid body, said compressor comprising a closed crankcase and at least one cylinder communicating with said crankcase, a piston slidably fitted within said cylinder and cooperating therewith to provide a compression chamber, means for operating said piston in said cylinder in a reciprocating motion to provide compression of said gas on the forward stroke of said piston and suction on the return stroke of said piston, means for admitting gas to be compressed into said compression chamber during said suction stroke of said piston, means for discharging said gas outside said shell from said compression chamber during said forward stroke of said piston, means providing at least one passageway providing communication between said crankcase and said liquid body, the fit between said piston and said cylinder permitting some compressed gas to bypass said piston to said crankcase and thence pass through said passageway and said liquid body during operation of said piston; the passage of gas through said oil body reducing its ability to transmit sound wave energy.



3. In refrigeration apparatus, a gas containing shell, a compressor spaced from said shell and resiliently mounted in said shell for operation therein, said compressor comprising in a lower portion thereof a closed crankcase and at least one cylinder which intercommunicate, a body of oil in said shell and in which is submerged the lower portion of said compressor including at least part of said crankcase, a piston slidably fitted within said cylinder and cooperating therewith to provide a compression chamber, means for operating said piston in said cylinder in a reciprocating motion to provide compression of said gas on the forward stroke of said piston and suction on the return stroke of said piston, means for admitting gas to be compressed first into said shell and then into said compression chamber during said suction stroke of said piston, means for discharging said gas outside said shell from said compression chamber during said forward stroke of said piston, means providing at least one passageway for communication between said crankcase and said oil body, the fit between said piston and said cylinder permitting some compressed gas to bypass said piston to said crankcase and thence through said passageway to said oil body during reciprocating motion of said piston, whereby during the operation of said piston the pressure in said crankcase exceeds the pressure within said shell and bypassed gas is bubbled through said oil body and discharged into said shell, the bubbling of gas through said oil body reducing its ability to transmit sound wave energy.

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