

Oct. 18, 1966

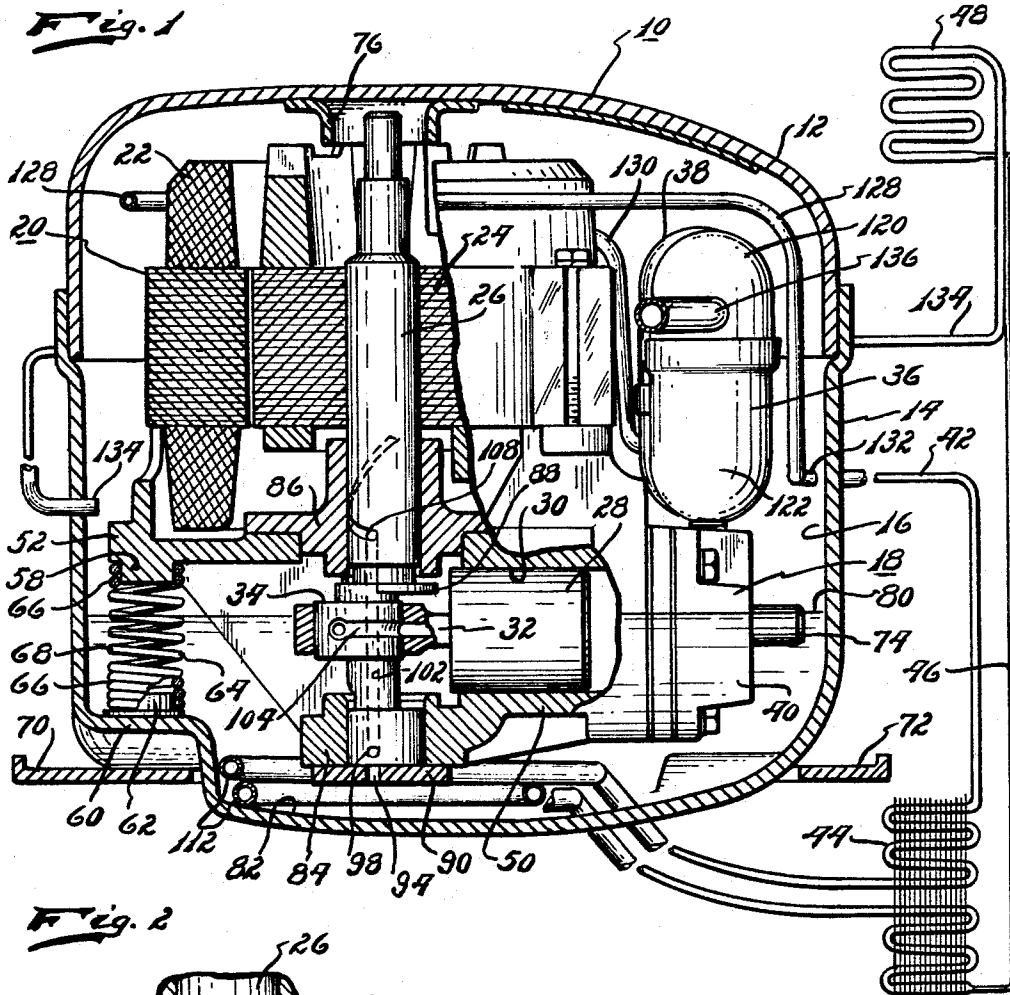
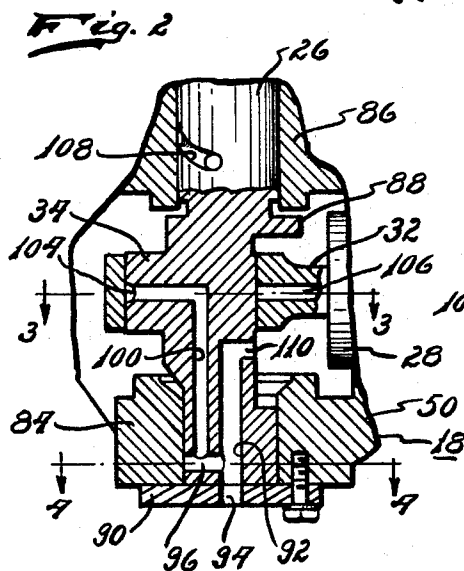
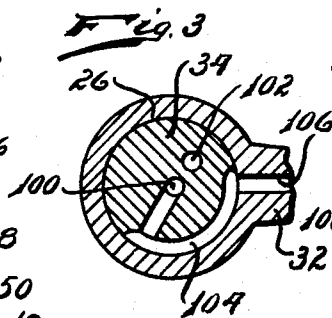
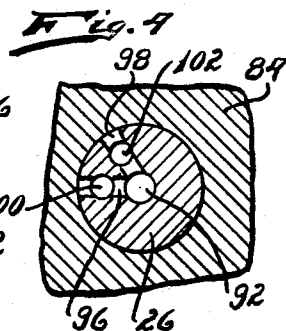
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3,279,683

MOTOR-COMPRESSOR UNIT

Filed Sept. 21, 1964

2 Sheets-Sheet 1



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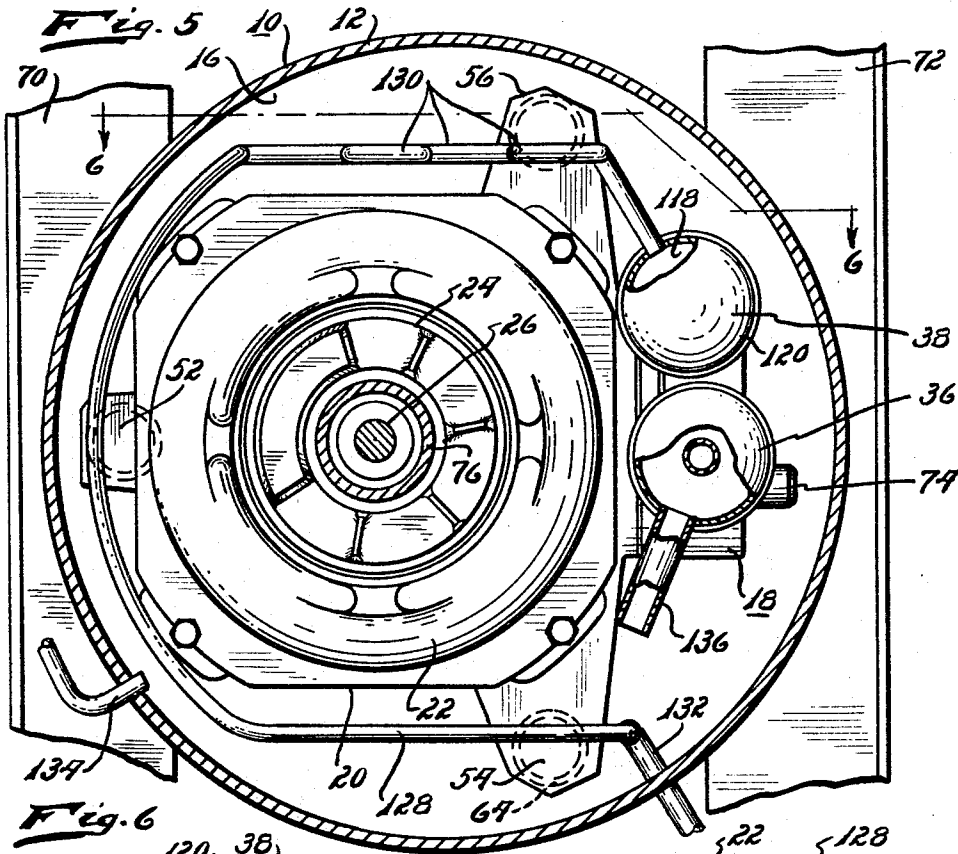
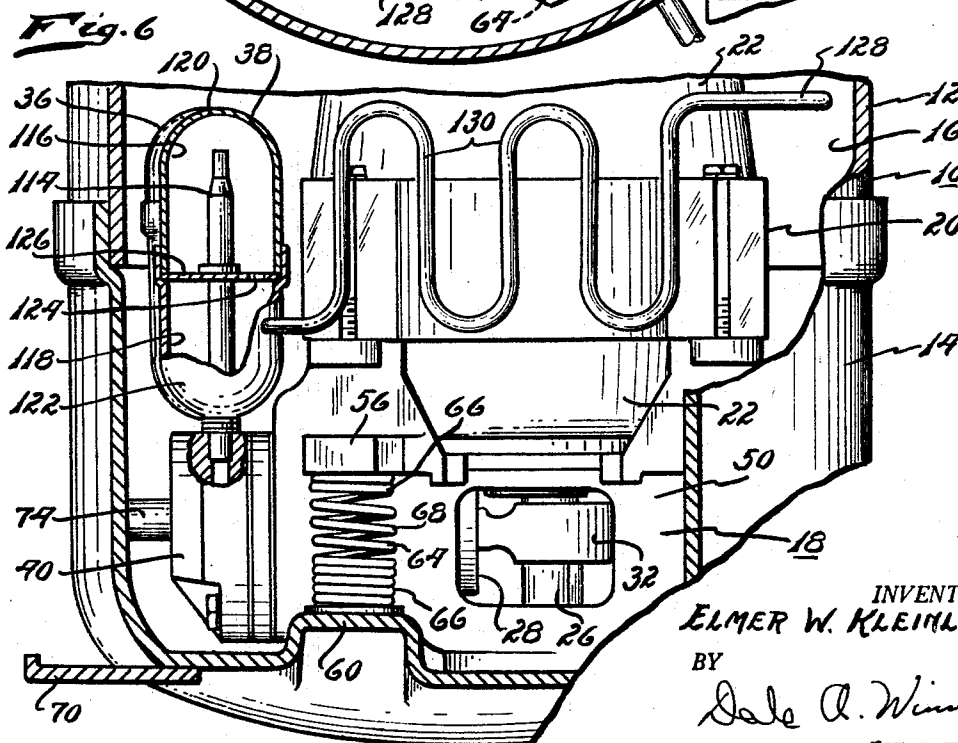
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MOTOR-COMPRESSOR UNIT

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2 Claims. (Cl. 230-58)

This invention relates to refrigeration apparatus in general and more particularly to motor-compressor units for use with household refrigerators, air conditioners and the like.

Motor-compressor units which are used with household refrigerators and air conditioners are normally hermetically sealed fractional horsepower units which are made as small in size and as noiseless in operation as is possible. They usually include an electric motor which drives either a rotary or a reciprocal compressor and both are mounted on a spring supported framework in a housing shell which is intended to help blanket all valve and motor noises.

The principal problem with respect to present motor-compressor designs is reducing their size while maintaining a low noise level and improved operational efficiency. Any change in the units, however slight, can cause small losses in one place or another which are proportionally big losses because of their small size. Volumetric efficiencies can vary 15 to 25% from theoretical expectations due to clearances, leakage, cylinder superheat and the like. As a consequence, every change made in a small motor-compressor unit is significant and produces a new and different piece of equipment with performance characteristics that must be established anew by actual testing.

It is an object of this invention to disclose a new and improved motor-compressor unit having certain features of principal interest but also being of over-all interest and significance.

Specifically, the motor-compressor unit of this invention is more compact in arrangement than most other units of like size and capacity.

The motor-compressor unit of this invention includes a large oil reservoir or sump which helps to assure lower balanced pressure in the system for easier starting of the compressor.

The intake and exhaust mufflers for the compressors are removed from under the compressor, where they are usually disposed, to a position over and above the oil reservoir.

The lubrication system is modified to include a breather passage to more readily enable the release of refrigerant from the lubricant and to do so at the operating level of the oil.

The housing shell is formed for close fitted engagement about the motor-compressor unit with suitable spring mounting isolators and damper plates to minimize the noise level.

The compressor itself operates in a flooded and more thoroughly lubricated field. Accordingly, it is subject to less friction and heat losses than previously. The oil itself is cooled by a couple of passes of the condenser coil provided therein.

These and other objects and advantages to be gained in the practice of this invention will be more fully understood and appreciated upon a reading of the following specification having reference to the accompanying drawings.

In the drawings:

FIGURE 1 is a partially cross-sectional plan view of the motor-compressor unit of this invention as seen inside the housing shell showing certain important features;

FIGURE 2 is an enlarged fragmentary and partially cross sectioned view of the drive shaft and support means as seen in FIGURE 1;

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FIGURE 3 is a cross sectioned view of the lubricating and vent passages in the drive shaft as seen in the plane of line 3-3 of FIGURE 2 and looking in the direction of the arrows;

FIGURE 4 is another cross-sectional view of the passages in the drive shaft, but as seen in the plane of line 4-4 of FIGURE 2 and looking in the direction of the arrows;

FIGURE 5 is a top plan view of the motor-compressor unit of FIGURE 1 with the upper shell of the housing removed;

FIGURE 6 shows the other side of the motor-compressor unit, from that shown by FIGURE 1, and has certain parts broken away to illustrate certain features more clearly.

The motor-compressor unit 10 is shown to include an upper housing shell 12 and a lower housing shell 14 which are hermetically secured together to provide an enclosed space 16 therewithin.

A compressor 18 is provided in the lower housing shell 14 and a motor 20 is provided thereover. The motor includes a stator 22 and a rotor 24 which is provided on a shaft 26. The compressor includes a piston 28 in a cylinder bore 30 and has a connecting rod 32 operatively engaged to an eccentric 34 formed on the lower end of the rotor shaft.

A pair of mufflers 36 and 38 are mounted on the cylinder head 40 of the compressor. The one, 36, serves as an intake muffler and the other, 38, is the exhaust muffler. The latter is connected by a discharge line 42 through the housing shell to a condenser 44. The condenser is connected by a restricted line 46 to an evaporator 48. The refrigerant is returned from the evaporator to the motor-compressor unit after it has served its intended purpose of cooling in the evaporator.

Referring now to certain significant features;

The compressor 18 is part of the casting 50 which includes tri-pod support pads 52, 54 and 56 with spring seats or posts 58 provided on the underside thereof. The lower housing shell 14 is, in turn, formed to include upwardly projecting indentations 60 which form spring seats and include spring centering posts 62.

Suspension support springs 64 are provided on the spring seats and posts 58 and each includes a series of close wound turns 66 near each end and the usual spaced turns 68 therebetween.

The suspension springs 64 will be appreciated as being axially aligned relative to the motor shaft 26 and to support the full weight of the motor and compressor parts in the housing. The close wound turns 66 at the end of the springs facilitate their engagement with the spring posts 58 and 62. Also, a certain number of the close wound turns are exposed beyond the spring seats, as shown at their lower ends in the drawing figures, for dissipating lateral deflections without changing the amount of vertical stiffness and/or resilience designed into the system.

The motor-compressor unit 10 includes external cross brace supports 70 and 72, a transit stop 74 on cylinder head 40, and a stop collar 76 for like use which form no part of this invention and are mentioned only for identification.

The suspension springs 64 support the compressor casting or block 50 with the compressor part partially submerged in a supply of lubricant at about the level of line 80 and in an oil sump 82 provided in the bottom of the housing shell 14. A lower journal bearing 84 and an upper journal bearing part 86 receive and support the shaft 26. A collar 88 formed on the shaft (reference FIGURE 2) and a thrust plate 90 secured to the block under the shaft fix the shaft against undue axial movement.

The drive shaft 26 includes a bore 92 and the thrust plate has an opening 94 aligned with the bore and providing means by which the journal bearings 84 and 86 may be lubricated. In this respect, lubricant enters the bore 92 through the opening 94 in the thrust plate and is centrifuged outwardly through passages 96 and 98 (reference FIGURE 4) to connecting bores 100 and 102. The one bore 100 connects to a groove 104 in the eccentric 34 of the shaft and in turn with a passage 106 in the connecting rod 32 for lubricating the piston rod pin (not shown). The other bore 102 communicates with a helix groove 108 about the shaft 26 and serves to lubricate the upper bearing 86.

The two passages 96 and 98 will be appreciated as providing lubricant through to the lower bearing and the whole arrangement is known as a flooded lubrication system.

Referring back to the bore 92, it is extended upward on the center line of the shaft 26 and terminates in a cross bore 110 just below the piston connecting rod 32. It serves as a vent or bleed hole for refrigerant absorbed and trapped in the lubrication oil when the refrigeration cycle is inactive and which is released when the system is operative.

The lubricant in the sump 82 is provided with a couple of coils 112 tapped into the condenser 44 to provide some cooling.

Referring now to FIGURE 6:

The exhaust muffler 38 is shown to include a standpipe 114 which passes through two chambers 116 and 118 formed by the mating muffler cans 120 and 122. The compressed refrigerant gas or vapor is exhausted into the chamber 116 and flows through a suitable opening 124 in the baffle wall 126 to the second chamber 118 and hence to the discharge line 128.

The discharge line 128 is formed to include a series of closely disposed serpentine bends 130 or undulations which lie in spaced relation between the motor 20 and the housing shells 12 and 14. Referring to FIGURE 5, it will be noted that the convolutions or bends 130 in the discharge line are along one side of the drive motor 20 and close after the exhaust muffler 38. The discharge line 128 is then extended up and around the drive motor, between it and the housing shells, to the other side of the enclosed space, drops down and is received in a fitting 132 that passes through the side wall of the lower housing shell 14. The high-pass loop of the discharge line greatly facilitates assembly, in being easier to get ahold of, and aside from this has functional advantages of occupying less space, being compact in arrangement, etc.

The return line 134 from the evaporator 48 enters the housing relatively across from the undulating part of the discharge line 128. FIGURE 6 shows its position more clearly as being adjacent and against a wall of the stator and supporting casting. This is to prevent the returning refrigerant gas from impinging directly on the motor windings and causing erosion.

The inlet to the intake muffler 36 is simply a short tubular piece 136 as best seen in FIGURE 5.

The motor-compressor unit 10 is charged with a refrigerant gas or vapor; such as Freon 12. It is also supplied with lubricant to the level of the line 80, as previously mentioned. This is a much higher level and greater capacity of lubricant than is normally permissive because the mufflers 36 and 38 are removed from the oil sump area. When the mufflers are in the sump they must be formed in the block or otherwise made to avoid oil leaks and they displace a considerable amount of lubricant in the small space available.

With more lubricant there is greater absorption of the refrigerant, when the system is inactive, and there is a much lower starting pressure to be overcome by the compressor.

The evaporator 48 supplies spent refrigerant to the enclosed space in the housing shells and it is circulated in the

housing by the revolving rotor to help keep the temperature of the motor down.

The high temperature low pressure refrigerant gas is drawn into the compressor 18 through the muffler 36 and is exhausted at a higher temperature and pressure condition through the exhaust muffler 38. The hot gas discharge from the muffler 38 passes through the discharge line 128 which is formed and disposed to provide minimum heat transfer to the enclosed space within the housing area. The refrigerant passes to the condenser 44 where the temperature is dropped and, in the course, a couple of passes are returned to the oil sump in the housing to cool the lubricant and consequently the lower journal bearing for shaft 26, as well as the enclosed space in the housing, somewhat.

The refrigerant passes through the restricted line to the evaporator 48 where it is expanded and absorbs heat in the normal course of serving its intended purpose.

The motor 20 is driven from a power source connected to a terminal box on the lower housing shell sidewall (not shown). The shaft 26 rests its lower end on the thrust plate 90 and as it rotates it draws lubricating oil up along its side walls and throws it out by centrifugal action into the passages 96 and 98. These in turn connect to bores which feed the connecting rod, the upper bearing, etc. as previously mentioned.

The shaft bore 92 is on the center line of the drive shaft and is itself not intended as an oil feed passage beyond its junction with the other feed passages. Instead, it serves as a vent passage for the escape of refrigerant gas entrapped in the lubricant during the inactive part of the motor-compressor cycle and released during operation of the compressor and agitation of the oil in the housing sump.

From the foregoing, several new arrangements of parts will be appreciated and the greater simplicity and compactness of the assembly should also be apparent. The overall advantages in the new assembly are the improved performance in the mounting, the lubrication system and the ease of manufacturing and assembly without any sacrifice of performance or efficiency of operation but in fact with an overall improvement.

I claim:

1. In refrigerating apparatus including a housing having an upper and a lower shell secured together to provide an enclosed space therebetween, a compressor mounted in the lower shell, a drive motor received and supported over the compressor and partly within the upper shell, a vertical shaft provided by the motor and operatively engaged to the compressor, a supply of lubricant provided in the lower shell, and a vaporous refrigerant introduced into said housing and subsequently into said compressor, the improvement, comprising:

a tripod support for said compressor and motor in said housing and including spring post seats formed from the side and bottom walls of the lower housing shell and projected upwardly therewithin,

coiled compression springs received on said posts and including close wound turns at the ends thereof for better seating and reduced supporting height without loss of lateral flexibility,

a supply of lubricant provided in the lower housing shell and partially submerging said compressor for flooded lubrication thereof,

said compressor having a hot gas discharge line connected to the output side thereof and formed to include serpentine bends received in spaced relation between the motor and said housing shells, on essentially only one side thereof, a refrigerant input line provided through the lower shell of said housing and removed from the serpentine bends in said discharge line,

and a section of said discharge line, between the serpentine bends and the outlet end thereof, received in the annular space between the upper end of said motor

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and the upper disposed housing shell and extended to the other side thereof.

2. The refrigerating apparatus of claim 1, said compressor including a casting formed to provide journal bearing support for the lower disposed end of said drive shaft in said supply of lubricant, a thrust plate engaged to said casting and disposed over the end of said drive shaft, an upper bearing support for said shaft, and a centrally disposed common passage formed through said shaft and said thrust plate for the passage of lubricant to said upper bearing support and for the vented release of entrapped refrigerant vapor from said lubricant at the operating level thereof.

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