

[54] **INTERNAL LIQUID REFRIGERANT TRAP FOR HERMETIC COMPRESSORS**

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 [51] Int. Cl. .... **F04b 39/12**  
 [58] Field of Search ..... 417/312, 313, 372, 415, 417/419, 902; 184/6.23, 104 R

[56] **References Cited**  
**UNITED STATES PATENTS**  
 3,385,515 5/1968 Parker ..... 417/419 X

3,486,687 12/1969 Ayling ..... 417/312

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[57] **ABSTRACT**

A multi-cylinder hermetic compressor of the vertical crankshaft type has a liquid refrigerant return reservoir in the form of an upwardly-open, channel-shaped trough mounted on top of and in heat exchange relation with the annular discharge gas muffler, and is provided with oil bleed drain openings and with overflow notches, both located above the cylinder heads so that any liquid refrigerant passing downwardly through either the holes or the notches will spill onto the hot cylinder heads.

**5 Claims, 2 Drawing Figures**

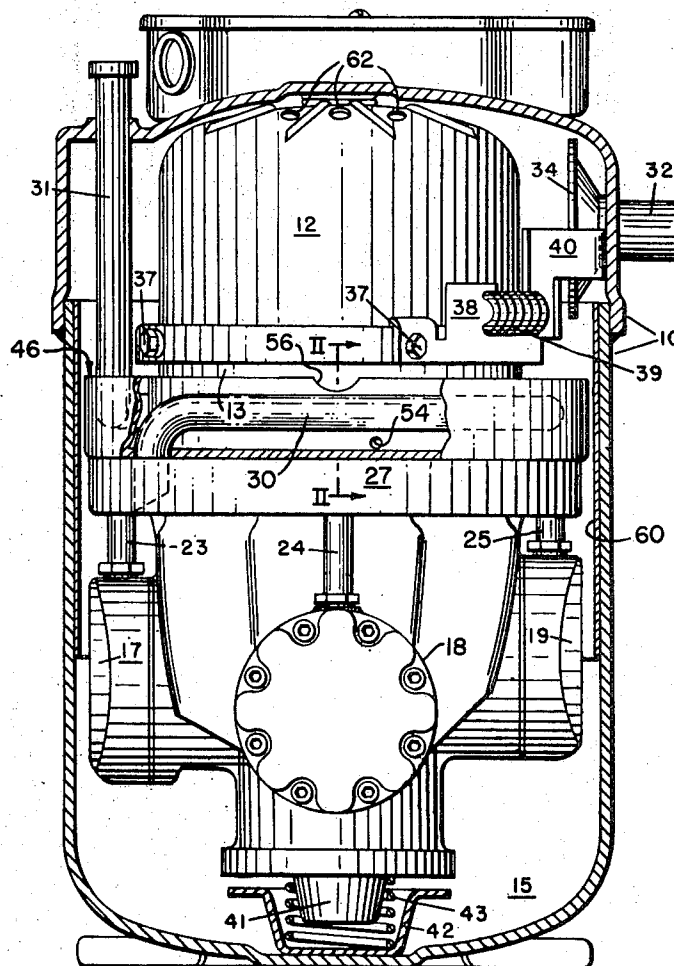


FIG. 1

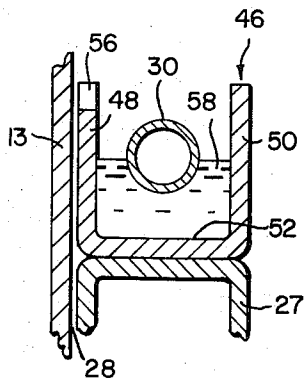
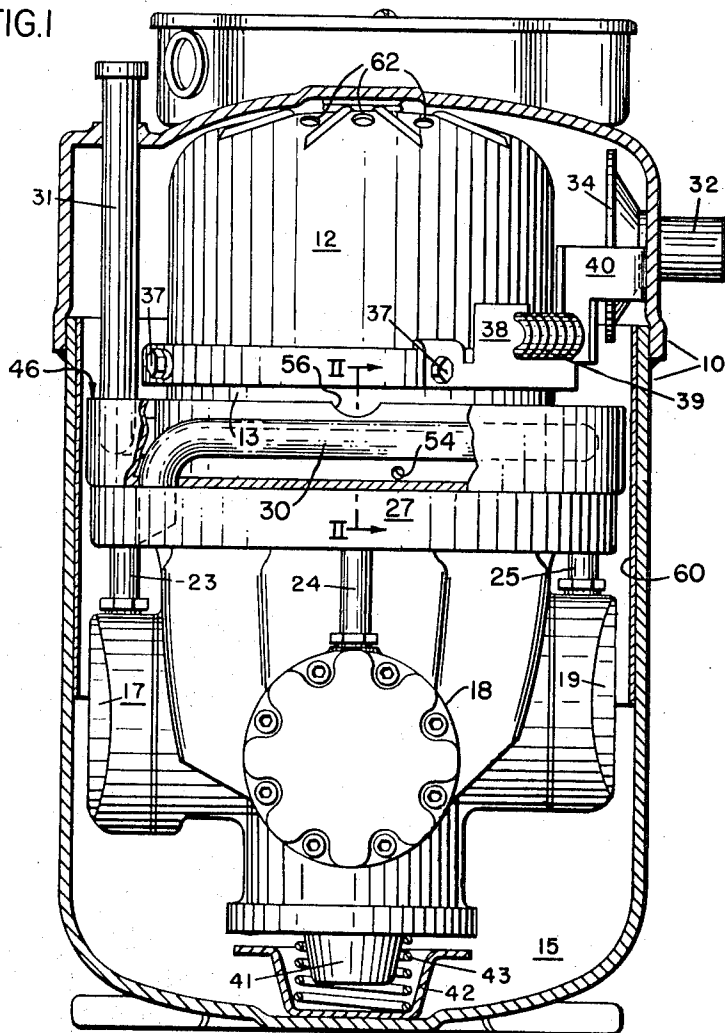


FIG. 2

## INTERNAL LIQUID REFRIGERANT TRAP FOR HERMETIC COMPRESSORS

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention:

The invention pertains to the art of handling liquid refrigerant returned to the interior of a hermetically sealed compressor.

#### 2. Description of the Prior Art:

The closest prior art of which applicant is aware is U.S. Pat. No. 3,486,687. The liquid return arrangement of that patent takes the form of a generally cup-shaped inner shell which extends from above the discharge muffler to a location near the bottom of the casing where it encompasses the crankcase wall. While that arrangement is effective for its intended purpose, it also has several disadvantages. Among these disadvantages is that it requires the use of substantially more material than that required for an arrangement according to my invention. Additionally, the relatively small annular gap between the exterior of the inner shell and the interior face of the outer casing and a noise dampening sleeve can at times result in a pumping action of foaming oil through this annular gap upon the start-up of the compressor after an extended period of shutdown. The foaming oil can be pumped up to the top of the compressor and enter the gas inlet openings at the top of the compressor motor, which is an undesirable situation. An arrangement according to my invention is not beset with these disadvantages.

### SUMMARY OF THE INVENTION

In accordance with my invention, a liquid refrigerant reservoir is mounted on top of and in heat exchange relation with the annular muffler, and is upwardly-open at least in that portion thereof which underlies the suction gas inlet of the compressor to receive liquid refrigerant entering through the suction gas inlet, the liquid reservoir also including means defining a drain opening located above at least one of the compressor cylinders and toward the radially inner side of the reservoir, with the drain opening being sized to restrict substantial flow of liquid refrigerant therethrough while permitting flow of lubricating oil therethrough. In the currently preferred form of the invention the liquid reservoir is channel-shaped in cross section, is upwardly-open, overlies the entirety of the annular muffler, and is provided with one of the drain openings above each of the cylinder heads of the compressor. Further, the radially inner wall of the trough includes overflow notches along the upper edge thereof, with the notches being located above the compressor cylinder heads so that any overflow of liquid results in spillage upon the hot cylinder heads. Finally, the arrangement accommodates having the hot gas discharge line from the muffler extending in generally nested relation along the trough.

### DRAWING DESCRIPTION

FIG. 1 is a side view of a refrigerant compressor having the invention applied thereto, with the outer casing shown in cross section, and the trough being broken in part.

FIG. 2 is a vertical cross-sectional view corresponding to one taken along the line II—II of FIG. 1.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The basic construction of the refrigerant compressor is generally the same as that described in U.S. Pat. No. 3,171,588 and 3,259,307, to which reference should be had for an explanation of the overall operation and structure of the compressor. However, a brief description of some of the basic parts of the compressor will be made to promote an understanding of the invention.

Referring to FIG. 1, a general cylindrical outer shell 10 has an upper portion extending around a motor cover 12 and has a lower portion with an oil sump 15 in its bottom. An electric motor (not shown) within the cover 12 and a cylindrical inner shell 13, which is cast integrally with the compressor cylinders, has a rotor (not shown) attached to a crankshaft (not shown) of the compressor. The compressor has cylinder heads 17, 18 and 19, and another cylinder head (not shown) opposite the cylinder head 18. Discharge gas tubes 23, 24 and 25 extend from the cylinders into a discharge muffler 27 which is generally toroidal shaped and supported by the gas discharge tubes. The muffler 27 fits relatively closely to the inner shell 13 but with a small gap 28 therebetween. A common discharge gas line is provided for conveying the discharge gas from the muffler out through the casing to a condenser (not shown). This discharge gas line includes a vibration loop portion 30 of curved form extending most of the way around the inner shell 13 and directly above the muffler 27, and a vertical portion 31. A suction gas tube 32 from an evaporator coil (not shown) extends through the upper portion of the shell 10, and has a diverging open end 34 which serves as the suction gas inlet to the compressor. The motor cover 12 has a bracket 38 connected thereto by studs 37. The bracket 38 is attached to one end of coil spring 39, the other end of which is attached to bracket 40 which is attached to the shell 10. At the bottom end of the compressor, a bearing housing 41 below the crankcase has a spiral spring 43 therearound, with the bottom end of the spring being within cup 42.

In accordance with the invention, a liquid refrigerant reservoir 46 (FIGS. 1 and 2) is mounted on top of and in heat exchange relation with the top wall of the muffler 27. As illustrated and in its currently preferred form, the reservoir is a channel-shaped trough having radially inner and outer walls 48 and 50, respectively, and a bottom wall 52 which is welded to the top wall of the muffler. The trough is upwardly-open at least in that portion underlying the suction gas inlet 34, and from a manufacturing standpoint is preferably upwardly-open throughout its total extent.

At least one small drain hole 54 is located near the bottom of the trough in the radially inner side wall 48 and above one of the cylinder heads (above cylinder head 18 in FIG. 1), and in the preferred form such a drain hole is located above each of the cylinder heads.

The radially inner wall 48 of the trough also includes one or more overflow notches 56 along the upper edge of the wall, with these notches also being located above the respective cylinder heads.

The manner in which the arrangement according to the invention serves its function is as follows: Any refrigerant liquid and lubricating oil entrained in the suction gas will drop into the trough 46. The refrigerant liquid will ordinarily be evaporated by the heat trans-

ferred from the muffler 27 and the hot discharge vibration loop which is generally nested in the trough. The function of the small drain holes 54 is to permit the lubricating oil to return to the oil sump 15 but not permit any substantial flow of refrigerant liquid therethrough. However, these drain holes are located directly over a cylinder head so that to the extent any liquid refrigerant does pass through the holes, it will spill onto the hot cylinder head and thus be evaporated rather than entering the oil sump.

If under a particular operating condition the amount of refrigerant liquid contained in the trough rises to the level of the notches 56, an overflow will occur at the notches. These notches are also located above the cylinder heads so that any such overflow will spill onto the hot cylinder heads and evaporate at least a portion of that overflow to reduce the amount of refrigerant liquid which can enter the sump.

It will be appreciated that while the currently preferred form of the trough is that of an upwardly-open channel encircling the entirety of the shell, and having drain holes and notches above each cylinder, it would not be essential that the trough comprise a full circle, or that the trough be upwardly-open throughout its extent.

One of the advantages of the arrangement according to the invention as contrasted to that of the noted U.S. Pat. No. 3,486,687 will perhaps be better understood in connection with the following comments. With the inner cup-shaped shell of that patented arrangement, a narrow annular gap is formed between the outer face of that shell and the inner face of the casing and noise dampening sleeve 60. Under a condition of extended period shutdown, so that pressure equalization in the system takes place, the subsequent stand-up can result in substantial foaming of the lubricating oil caused by the refrigerant in the oil and the reduced pressure in the casing upon start-up. As a result, the oil can be in effect pumped upwardly through the narrow annular gap toward the top of the compressor casing and enter the suction gas inlet holes 62 at the top of the motor cover 12. This condition is undesirable, and does not occur with the arrangement according to my invention because the only narrow gap is of limited height and at

a relatively high level in the compressor casing.

I claim:

1. In a multi-cylinder refrigerant compressor of the vertical crankshaft type having a hermetically sealed outer shell, radially extending cylinder heads in the lower portion of the shell with discharge tubes extending upwardly to an annular discharge muffler encircling the compressor motor, a suction gas inlet in the upper portion of said shell, and an oil sump in said shell, a liquid refrigerant trap system comprising:

a liquid refrigerant reservoir mounted on top of and in heat exchange relation with said muffler and being upwardly-open at least in that portion thereof underlying said suction gas inlet to receive liquid refrigerant dripping from said inlet, said reservoir extending for a distance equal to at least half a circle;

said reservoir including means defining a drain opening located above at least one of said cylinder heads and toward the radially inner side of said reservoir, said drain opening being of a size to restrict passage of liquid refrigerant therethrough while permitting passage of oil therethrough.

2. In a compressor according to claim 1 wherein: said reservoir comprises a channel-shaped trough overlying the entirety of said muffler, and being upwardly-open throughout its extent.

3. In a compressor according to claim 1 including: one of said drain openings located above each of said cylinders.

4. A compressor according to claim 2 wherein: the radially inner wall of said trough includes overflow notches along the upper edge thereof, said notches being located above said cylinder heads so that with an overflow of liquid refrigerant the spillage drops onto said cylinder heads.

5. In a compressor according to claim 2 including: a discharge line for carrying discharge gas from said muffler through said casing is provided, said discharge line including a vibration loop portion of curved form extending in generally nested relation in said trough.

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