Dec. 5, 1967 M. R. BUTTS 3,356,293

REFRIGERATING APPARATUS

Filed Nov. 19, 1965 3 Sheets-Sheet 1

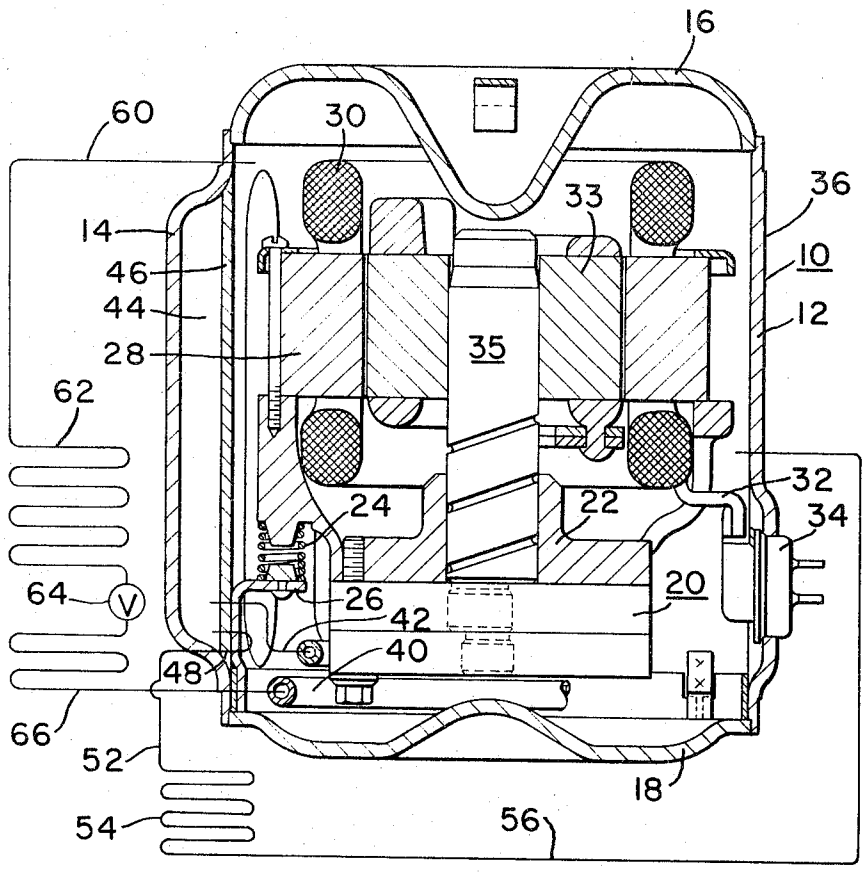


Fig. 1

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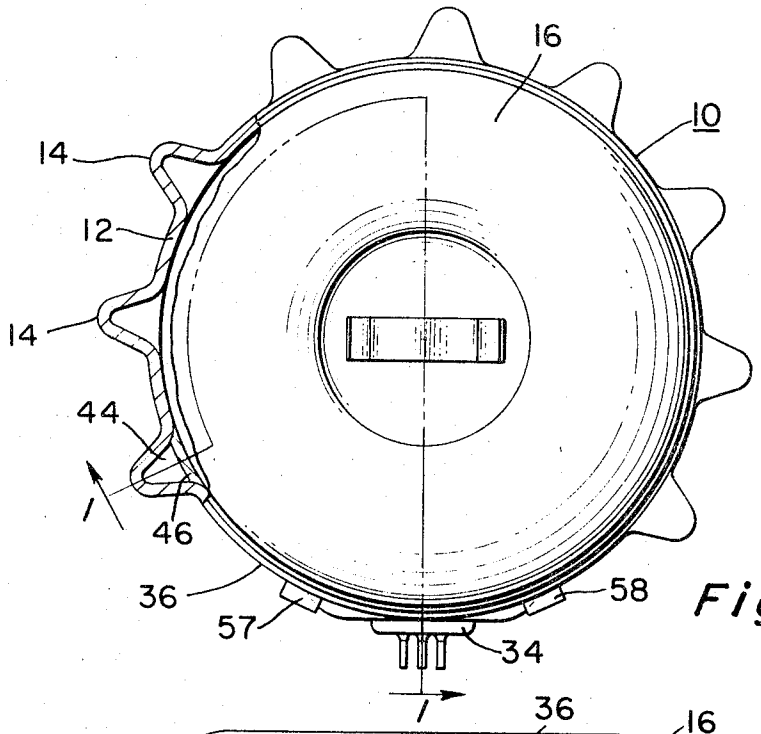


Fig. 2

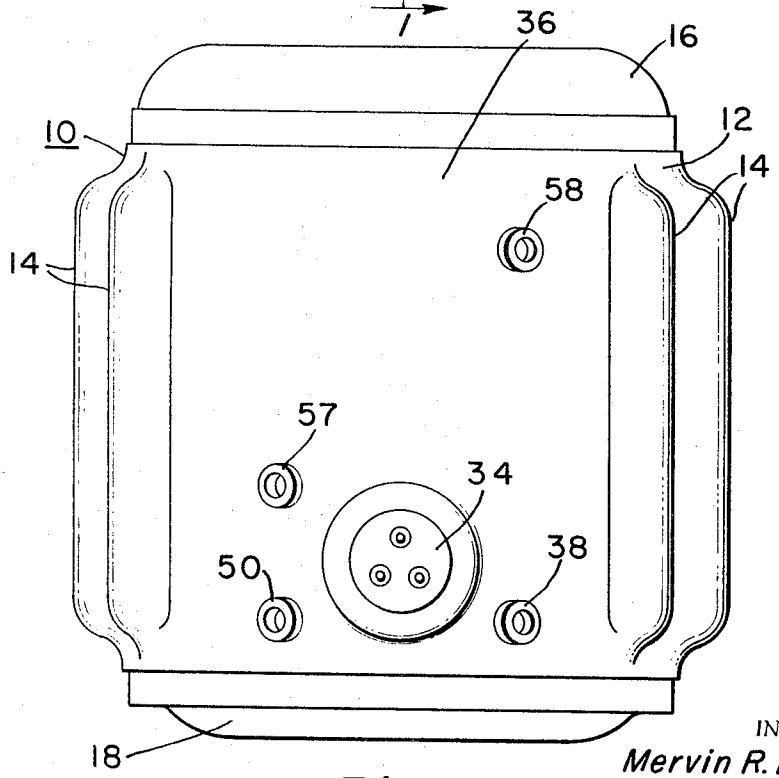


Fig. 3

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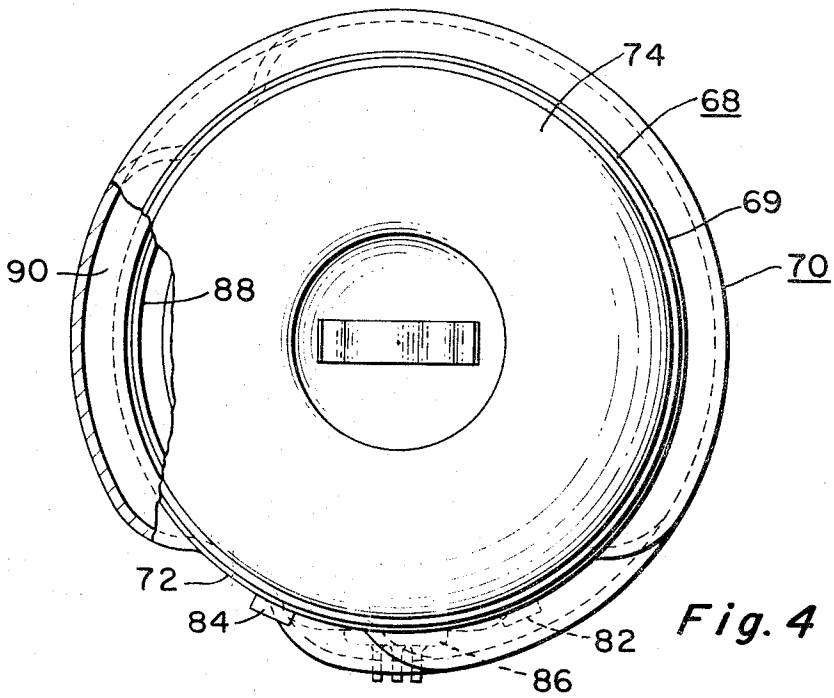


Fig. 4

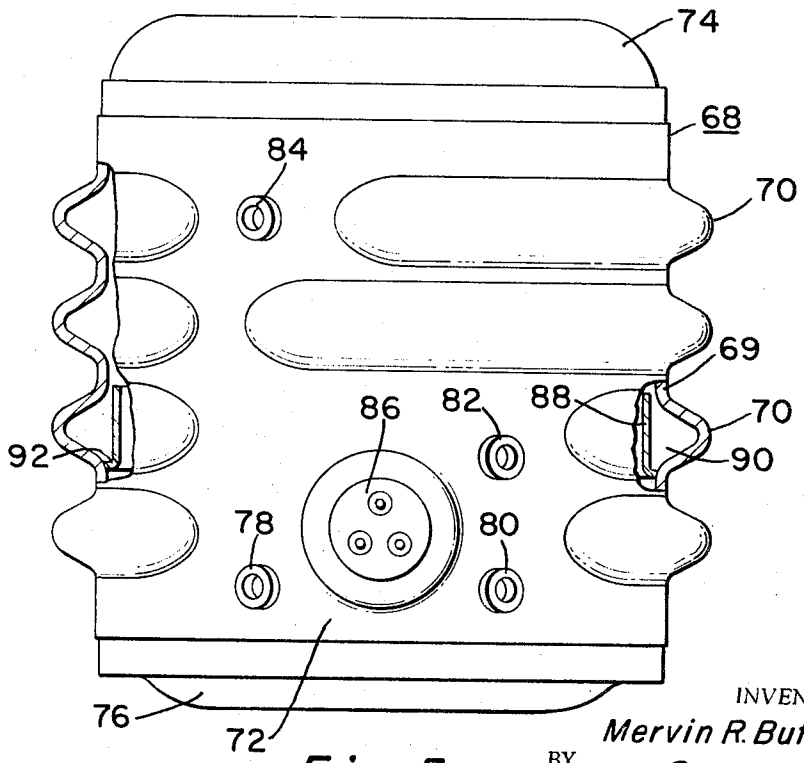


Fig. 5

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REFRIGERATING APPARATUS

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6 Claims. (Cl. 230—208)

ABSTRACT OF THE DISCLOSURE

In preferred form, a motor compressor unit located within a hermetically sealed sheet metal shell having a predetermined inside diameter and including a plurality of roll form convolutions therein that extend the inside surface of the hermetically sealed shell to improve transfer of radiant heat from the motor and through the compressor shell.

This invention is directed to refrigerant systems and more particularly to an improved hermetically sealed motor compressor unit for refrigerant systems and the like.

In hermetically sealed motor compressor units, one problem is to dissipate the heat generated by an electric motor and that heat generated by compressing a refrigerant or the like from within the shell to the exterior thereof.

Generally, it is the practice to include an extended surface fin structure on the exterior of the shell by connecting individual fin members thereto by resistance welding and the like. In certain cases, the shell of the compressor is cast to form integral fins thereon. While such arrangements are suitable for their intended purpose, they are relatively expensive in that in the case of the separate fins connected to the shell, several manufacturing steps are involved and in the case of cast fins, the amount of material needed to form the shell is increased as compared to sheet formed steel casings.

Accordingly, an object of the present invention is to improve hermetically sealed motor compressor units by the provision of a shell having constant wall thickness and wherein a plurality of relatively deep convolutions are integrally formed therein to reinforce the shell and form an extended heat transfer surface on the shell for efficiently transferring heat built up from within the shell exteriorly thereof.

Still another object of the present invention is to improve hermetically sealed motor compressor units by the provision of an open ended shell having a uniform wall thickness wherein the shell is deformed through a substantial portion of the planar extent thereof by a plurality of deep-drawn convolutions that eliminate the need for attaching an extended surface fin structure on the exterior of the shell.

Still another object of the present invention is to improve hermetically sealed motor compressor units by the provision of an open ended shell having convolutions as set forth in the preceding object, wherein means are provided in association with at least one of the convolutions to form an integral muffler within the compressor for damping discharge pulsations from the compressor.

Still another object of the present invention is to improve hermetically sealed motor compressor units having convolutions as set forth above, wherein means are provided within the compressor to cooperate with at least one of the convolutions to form an oil separation region within the compressor.

Further objects and advantages of the present invention will be apparent from the following description,

reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a vertical sectional view showing one embodiment of the invention in association with a diagrammatically illustrated refrigerant circuit;

FIGURE 2 is a top elevational view, partially in section, of the compressor in FIGURE 1;

FIGURE 3 is a front elevational view of the compressor shown in FIGURE 1;

FIGURE 4 is a view in top elevation, partially in section, of another embodiment of the present invention; and

FIGURE 5 is a view in front elevation and partial section of the embodiment in FIGURE 4 partially shown in vertical section.

Referring now to the embodiment of the invention illustrated in FIGURES 1 through 3, a hermetically sealed motor compressor unit **10** is illustrated including a cylindrical open ended shell **12**. The shell includes a plurality of circumferentially located longitudinally directed convolutions **14** that are directed substantially through the complete length of the shell **12**. The convolutions are integrally formed in the shell by rolling, die forming or the like. The shell **12** including the convolutions **14** have a substantially uniform wall thickness and, as best seen in FIGURE 2, the convolutions **14** are relatively deeply drawn radially outwardly with respect to the nominal diameter of the shell **12** whereby the apexes of the convolutions **14** are located radially outwardly of the nominal diameter of the shell **12** a distance at least three times the nominal thickness of the shell **12**.

The open ends of the shell **12** are sealed by end closure plates **16**, **18**, respectively, that are suitably fastened to the shell **12** at either end thereof by roll welding or the like.

Within the shell **12** is located a compressor **20** representatively shown as being of the rotary type. A main casting **22** of the compressor **20** is resiliently supported by a plurality of circumferentially located springs **24**, one of which is illustrated in FIGURE 1. The springs **24** are secured to support brackets **26** off the inner surface of the shell **12**.

A stator block **28** of an electric motor is secured on upwardly directed extensions of the main casting **22** and a stator coil **30** is supported thereon which is electrically energized through a lead wire **32** that is electrically connected to a terminal block **34** in one side of the casing **12** that is adapted to be electrically connected across a suitable source of power. A rotor **33** of the electric motor has a shaft **25** secured thereto for operating the compressor.

One side of the compressor shell **12** is without convolutions thereon to form an uninterrupted surface portion **36** on the outer periphery of the shell **12** through which is directed a suction fitting **38** having an inlet line **40** connected thereto that communicates with the inlet of the compressor **20**. A discharge line **42** from the compressor communicates with a muffling chamber **44** formed by one of the convolutions **14** and a plate **46** directed across the base of the convolution **14** and connected at its outer peripheral edges to the inside diameter of the compressor shell **12**. A conduit **48** is directed from the muffling chamber **44** and thence through a discharge fitting **50** on the uninterrupted surface portion **36** of the shell **12**. A conduit **52** is connected to the fitting **38** and to a superheat coil **54** which, in turn, is connected by a conduit **56** to a refrigerant return fitting **57** that communicates with the interior of the shell **12**. Refrigerant cooled by the superheat coil thence passes through the shell **12** across the electric motor and is discharged through an outlet fit-

ting 58 on the surface 36. A conduit 60 directs fluid from the fitting 58 through a refrigerant condenser 62 which is connected through a refrigerant expansion device 64 for discharge into an evaporator coil 66 of the refrigerant system which, in turn, is connected to the previously described suction fitting 38.

In the above-described embodiment the integrally formed convolutions 14 of the shell reinforce the shell and define an extended heat exchange surface that acts to efficiently dissipate radiant heat from the coil 30 of the motor and the pumping chamber of the compressor 20. The integrally formed convolutions 14 eliminate the need for an exterior fin arrangement on the outer surface of the compressor that is connected thereto by resistance welding or the like. In heat transfer arrangements of the type including separately attached fins, it has been found that the connections of the fins to the shell often are such that they do not define a continuous heat transfer path for removing heat from the compressor shell 12. This problem is obviated in the present construction. Furthermore, by the provision of a shell 12 having a uniform wall thickness including the convolutions 14, the heat transfer path is reduced as compared to compressor shell arrangements wherein the wall is thickened at fins that are cast integrally on the outer surface thereof.

A further advantage of the convolutions 14 is that they are adaptable to form an integral muffling cavity in the hermetically sealed compressor merely by the provision of a single plate element that cooperates with one of the formed convolutions 14 to define an open space or chamber in which pulsing discharge flow from the compressor 20 can be damped. One such arrangement is shown in the embodiment of FIGURES 1 and 3 by the provision of the plate 46 that cooperates with one of the convolutions 14 to form the muffling cavity 44.

Another feature of the present invention is that by integrally forming convolutions 14 of the type illustrated in shell 12, and leaving an uninterrupted surface on the shell, both the heat transfer surface and the fluid connection openings of the hermetic compress can be formed in a single manufacturing operation. The structure, as characterized above, is such that the cost of construction of a hermetically sealed compressor unit is substantially reduced. In the embodiment of FIGURES 4 and 5 a hermetically sealed motor compressor unit 68 is illustrated that includes a compressor and motor of the type shown in the first embodiment. The compressor 68 includes a cylindrical outer shell 69 that has a plurality of spaced apart convolutions 70 formed therein directed circumferentially around the shell 69. Each of the convolutions 70 has an apex portion thereof spaced a substantial distance radially outwardly of the nominal diameter of the shell 69 and in the illustrated embodiment, each of the convolutions 70 has spaced apart ends thereon that are separated by an uninterrupted surface 72 on the outer periphery of the shell 69. The illustrated convolutions 70 have dimensional characteristics like the convolutions set forth in the first embodiment and thereby present an extended heat transfer surface in the shell 69 for dissipating heat from interiorly of the compressor 68. In this embodiment of the invention, the open ends of the cylindrical shell 69 are sealed by end closure members 74, 76.

As was the case in the first embodiment, the compressor is adapted to be included in a refrigerant system or the like and thereby includes various fluid fittings and electrical terminal connections on the uninterrupted surface 72 of the shell 69. These include a suction fitting 78, a discharge fitting 80, and a fluid return 82 corresponding, respectively, to the fittings 38, 50 and 57 in the first embodiment. Additionally, the compressor 68 includes an outlet fitting 84 for directing refrigerant from interiorly of the compressor 68 to the condenser of a refrigerant system, as disclosed in the first embodiment. Additionally, a terminal block 86 is located in the surface 72 for supplying power to an electric motor as disclosed in the first embodiment.

A further feature of this embodiment of the invention is that an L-shaped annular ring 88 is located within the shell 69 having one end thereof directed radially outwardly and connected to the inside surface of the shell below one of the convolutions 70 therein. The upper end of the ring 88 is spaced apart from the convolutions 70. The ring 88 serves as a baffle in alignment with the return fitting 82 whereby refrigerant that is returned from the superheat coil, which often has a certain amount of suspended oil particles therein, is passed circumferentially about the inner surface of the shell 69 through a space 90 between the baffle 88 and convolutions 70. The path of the fluid return to the inside of the shell 69 produces centrifugal action on the refrigerant to remove the heavy oil particles therefrom. These oil particles are collected in the space 90 and drained through openings 92 in the ring 88 to be collected in the bottom of the compressor.

The embodiment illustrated in FIGURES 4 and 5 has the advantage of construction as pointed out in the embodiment of FIGURES 1 through 3, and in addition to having the improved heat transfer characteristics above, also by virtue of the ring 88 in conjunction with one of the convolutions 70 serves as an efficient and very economical oil separator.

While the embodiments of the present invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In a hermetically sealed motor compressor unit the combination of, an open ended shell having a cylindrical shape with a predetermined inside diameter, a plurality of convolutions integrally formed in said shell, each of said convolutions extending across said shell between the open ends thereof, each of said convolutions having an apex portion thereof located radially outwardly of the inside diameter of said shell a distance at least three times that of the wall thickness of said shell to locate the inside surface of said shell radially outwardly of said predetermined inside shell diameter thereby to increase the radiant heat transfer surface area on the inside surface of said shell, end closure members for sealing the open ends of said shell, a compressor located within said shell in spaced relationship thereto, means including an electrical motor for driving said compressor, said convolutions in said shell having the inside surfaces thereof directly aligned in radiant heat transfer relationship with said motor and said compressor to transfer heat generated by operating said motor and said compressor exteriorly of said shell.

2. In the combination of claim 1, said convolutions formed longitudinally of said shell throughout substantially the full length thereof, said shell having a smooth surface portion thereon between said convolutions, a plurality of fluid fittings formed in said smooth surface portion of said shell, and an electrical terminal located in said smooth surface portion of said shell for supplying power to said electrical motor.

3. In the combination of claim 1, said convolutions extending transversely of said outer shell through substantially the full circumference of said shell, certain of said convolutions being terminated to have spaced apart end portions thereon, said shell having an unbroken surface portion between said spaced apart end portions of said convolutions, means forming fluid connections to said compressor at said unbroken surface portions of said shell.

4. In a hermetically sealed motor compressor unit the combination of, an open ended shell having a cylindrical shape with a predetermined inside diameter, a plurality of convolutions integrally formed in said shell, each of said convolutions extending across said shell between the

open ends thereof, each of said convolutions having an apex portion thereof located radially outwardly of the inside diameter of said shell a distance at least three times that of the wall thickness of said shell to locate the inside surface of said shell radially outwardly of said predetermined inside shell diameter thereby to increase the radiant heat transfer surface area on the inside surface of said shell, end closure members for sealing the open ends of said shell, a compressor located within said shell in spaced relationship thereto, means including an electrical motor for driving said compressor, said convolution in said shell having the inside surfaces thereof directly aligned in radiant heat transfer relationship with said motor and said compressor to transfer heat generated by operating said motor and said compressor exteriorly of said shell, a closure plate located within said shell extending across said shell and being connected thereto to form in cooperation with one of said convolutions an open space, means for connecting the discharge line from said compressor to said open space and means for connecting said open space exteriorly of said compressor, said open space serving as a muffling chamber for pulsating flow from the discharge side of said compressor.

5. In a hermetically sealed motor compressor unit the combination of, an open ended shell having a cylindrical shape with a predetermined inside diameter, a plurality of convolutions integrally formed in said shell, each of said convolutions extending across said shell between the open ends thereof, each of said convolutions having an apex portion thereof located radially outwardly of the inside diameter of said shell a distance at least three times that of the wall thickness of said shell to locate the inside surface area of said shell radially outwardly of said predetermined inside shell diameter thereby to increase the radiant heat transfer surface area on the inside surface of said shell, end closure members for sealing the open ends of said shell, a compressor located within said shell in spaced relationship thereto, means including an electrical motor for driving said compressor, said convolutions in said shell having the inside surface thereof directly aligned in radiant heat transfer relationship with said motor and said compressor to transfer heat generated by operating said motor and said compressor exteriorly of said shell, means located inside said shell for defining a baffle surface located in spaced relationship and throughout the length of one of said convolutions,

means for directing refrigerant into the space between said baffle and said convolution, said refrigerant passing between said convolution and said baffle thence interiorly of said shell for separating lubricant from said refrigerant.

6. In a hermetically sealed motor compressor unit the combination of, an open ended shell having a cylindrical shape with a predetermined inside diameter, a plurality of convolutions integrally formed in said shell, each of said convolutions extending across said shell between the open ends thereof, each of said convolutions having an apex portion thereof located radially outwardly of the inside diameter of said shell a distance at least three times that of the wall thickness of said shell to locate the inside surface area of said shell radially outwardly of said predetermined inside shell diameter thereby to increase the radiant heat transfer surface area on the inside surface of said shell, end closure members for sealing the open ends of said shell, a compressor located within said shell in spaced relationship thereto, means including an electrical motor for driving said compressor, said convolutions in said shell having the inside surface thereof directly aligned in radiant heat transfer relationship with said motor and said compressor to transfer heat generated by operating said motor and said compressor exteriorly of said shell, baffle means located inside said shell for defining a baffle surface located in spaced relationship and throughout the length of one of said convolutions, means for directing refrigerant into the space between said baffle and said convolution, said refrigerant passing between said convolution and said baffle thence interiorly of said shell for separating lubricant from said refrigerant, said baffle means including an annular ring supported on said shell about a predetermined portion of the periphery thereof, means forming openings in said annular ring for draining lubricant from the space between said shell and said annular ring to a sump region in said compressor.

References Cited

UNITED STATES PATENTS

2,146,097	2/1939	Touborg	230—58 X
2,215,991	9/1940	Anderson et al.	
2,440,593	4/1948	Miller	230—139 X

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