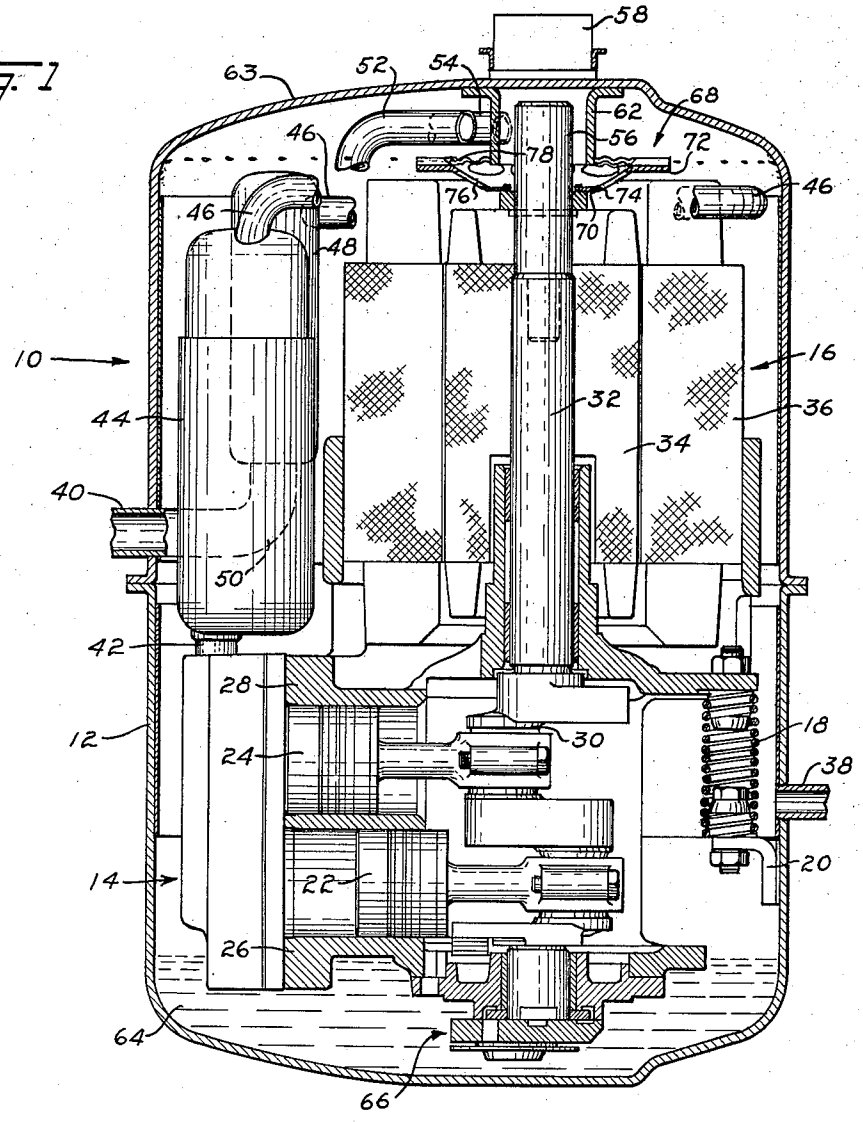
Sept. 17, 1963 J. HENNING ETAL 3,104,051

ANTI-SLUGGING DEVICE FOR MOTOR-COMPRESSOR UNITS

Filed Dec. 2, 1960

Fig. 1



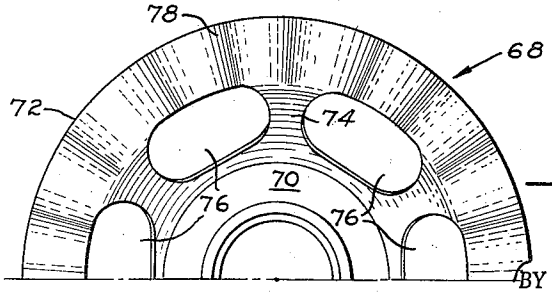


Fig. 2

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United States Patent Office 3,104,051 Patented Sept. 17, 1963

3,104,051
ANTI-SLUGGING DEVICE FOR MOTOR-COMPRESSOR UNITS

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Filed Dec. 2, 1960, Ser. No. 73,288
3 Claims. (Cl. 230—206)

This invention relates to hermetically sealed motor-compressor units especially adapted for use in refrigeration and air conditioning systems, and more particularly to a novel construction for preventing slugs or particles of liquid refrigerant or lubricant from being conducted to the compressor.

One of the principal problems in the operation of refrigeration compressors has been the possible entrance of slugs or particles of liquid refrigerant or lubricant into the compressor and the consequent objectionable noise and possible injury or destruction of the operating parts of the compressor. While many attempts have heretofore been advanced for the solution of this problem such as the use of surge drums in the suction line or specially designed compressor valves for accommodating liquids as well as gases, none of them have been completely successful, especially in the case of hermetically sealed motor-compressor units which must be designed for periods of long usage without the necessity of repairs.

It is accordingly one of the principal objects of the present invention to provide a novel construction for effectively ensuring that liquid particles will be efficiently separated from the gaseous refrigerant so that such liquid will be prevented from being conducted to the compressor intake.

A further object is to provide in a hermetically sealed motor-compressor unit, a novel centrifuge or anti-slugging device which is drivably connected with the motor shaft and which functions during operation of the unit to separate the liquid particles or slugs from the gaseous refrigerant through the action of centrifugal force, thereby permitting only the gaseous refrigerant to be conducted to the compressor intake.

Another object is to provide an anti-slugging device of lightweight construction which is formed in such a manner as to not only perform the aforesaid liquid separation, but also to effectively prevent foamed lubricant from entering the compressor inlet.

Still another object is to provide a device of the above character which is constructed to offer substantially unrestricted flow of gas to the compressor inlet while effecting the separation of foam or liquid particles as above set forth.

Other objects and novel features of the invention will appear more fully hereinafter from a consideration of the following detailed description when taken in connection with the accompanying drawing illustrative of a preferred embodiment of the invention. It will be expressly understood however, that the drawing is utilized for purposes of illustration only and is not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings, wherein similar reference numerals refer to similar parts throughout the several views:

FIG. 1 is a vertical sectional view of a motor-compressor unit constructed in accordance with the present invention, and

FIG. 2 is an enlarged partial plan view of the novel anti-slugging device of the invention.

Referring more particularly to FIG. 1, the present invention is illustrated therein as including a hermetically

sealed motor-compressor unit 10 including a hermetically sealed casing 12 which houses all of the working elements of the invention. More particularly, the unit 10 includes a conventional compressor 14 and an electric motor 16 for driving the compressor, these parts being interconnected and resiliently supported in the casing 12 by means of a plurality of springs and brackets, one each being shown at 18 and 20 respectively. The compressor 14 may be of any suitable type and is herein shown as being of the twin type and including a pair of pistons 22 and 24 within the respective cylinders 26 and 28, and also including a crankshaft 30 which is suitably drivably connected with motor shaft 32. The latter is provided with the usual rotor 34 with which stator 36 cooperates to effect motor and compressor operation as well known in the art.

The motor-compressor unit 10 is especially adapted for use in refrigerating and air conditioning systems and for this purpose the casing 12 is provided with an intake connection 38 for low pressure gaseous refrigerant and an outlet connection 40 for high pressure gaseous refrigerant, it being understood that these connections are suitable associated with the evaporator and condenser units respectively of the refrigerating system. The compressor discharge 42 is connected with the outlet connection 40 by way of a first stage muffler 44, a coil of tubing 46 surrounding the upper portion of the motor 16 and a second stage muffler 48 which latter is connected by a tube 50 with the outlet connection 40. The inlet or suction connections for the compressor include a pair of tubes 52 and 54 which are positioned adjacent the top portion of the casing 12 and which are provided with open inlet ends directed inwardly and closely adjacent the upper end 56 of the motor shaft 32. The suction tubes 52 and 54 are suitably connected with the intakes of the respective cylinders 26 and 28 in a well known manner so that during operation of the compressor 14 gaseous refrigerant conducted into the casing 12 through the inlet connection 38 will be drawn from the upper portion of the casing into the compressor intakes through the suction tubes 52 and 54.

As shown, an overload protector switch 58 of a conventional type is mounted on the exterior of the dome 60 of the casing 12 in order to interrupt the motor circuit in the event the temperature of the motor windings reaches a predetermined high value. In order to efficiently conduct heat from the motor to the switch 58 a thermal conducting ring 62 of copper or other metal having high heat conducting qualities is secured to the inner surface of the dome 60 and extends downwardly toward the motor rotor. Preferably the upper end of the motor shaft 56 extends into the ring 62 with slight clearance as shown, this arrangement serving to prevent undue oscillation or lateral movement of the motor-compressor unit about its spring supports 18 during shipment of the assembly.

In order to lubricate the working parts of the compressor and the various bearings of the unit, the casing 12 at its lower end contains a supply of liquid lubricant 64, and a suitable force feed lubricator 66 is provided at the lower end of the crankshaft 30 for conducting such lubricant to the working parts and bearings. Suitable passages and ports, not shown are provided for the circulation of the lubricant.

As heretofore set forth, one of the principal problems inherent in the operation of hermetically sealed motor-compressor units has been the necessity of effectively separating the liquid particles from the gaseous constituent of the gaseous refrigerant in order to prevent the entrance of such liquid particles into the compressor intake and consequent damage of the working parts of the com-

pressor. Novel means are accordingly provided by the present invention for solving such problem and in the form of the invention illustrated, such means includes an anti-slugging disc or centrifuge 68 which is secured to the upper shaft portion 56 and is positioned between the suction tubes 52, 54 and the upper end of the stator 36.

As shown, the disc 68 which is circular and formed of thin gauge metal or other rigid material compatible with the refrigerant employed, is dished or cone-shaped to provide a hub portion 70, a laterally directed rim portion 72 which extends in a plane normal to the axis of the motor shaft 32 and an upwardly directed cone-shaped body portion 74. Such body portion is provided with a plurality of spaced openings 76 for the passage of gaseous refrigerant from beneath the disc to the suction tubes 52 and 54 and preferably, the inlet ends of the latter are positioned so that such ends are substantially vertically aligned with the successive openings during rotation of the disc, this arrangement, securing substantially unrestricted flow of the gas from beneath the disc directly to the inlets of the suction tubes.

In order to provide a wide band of interception to liquid particles entrained in the gaseous refrigerant and to increase the centrifugal separation of such liquid particles, the rim portion 72 is corrugated at 78 throughout its peripheral extent, such corrugations serving to materially increase the turbulence, circulation and whipping action of the mixture to effectively separate the liquid and gaseous constituents.

During operation of the motor-compressor unit, it will be understood that low pressure gaseous refrigerant will be drawn into the casing 10 through the inlet connection 38 and will flow upwardly around the stator 36 and through the clearance space between the rotor 34 and the stator 36 toward the open ends of the suction tubes 52 and 54. Such gas impinges on the rotating disc 68 and any entrained liquid particles of oil or refrigerant will be thrown radially outwardly off the rim 72 by centrifugal force allowing only the gaseous refrigerant to flow into the suction tubes 52 and 54. While the corrugations 78 provide a relatively wide band of interception to the entrained liquid, the rim 72 presents a relatively thin edge to resist the gas flow. The openings 76 in the cone-shaped portion 74 allow free flow of gas from under the disc to the inlet ends of the suction tubes 52, 54 to avoid any undue throttling effect which might otherwise affect the compressor performance. It will be understood that any liquid particles entrained in the gas passing upwardly through the openings 76 will also be separated from the gas by centrifugal force.

In the event that the compressor has not operated for some time it is possible that a considerable amount of the gaseous refrigerant within the casing 12 may condense in the liquid lubricant. When the compressor is started, the reduction of pressure within the casing causes the refrigerant to evaporate, the boiling action causing a foaming of the oil, which foam may almost completely fill the casing. The present invention including the anti-slugging disc 68 keeps the inlets of the suction tubes 52 free of the foamed oil in the same manner as it separates entrained liquid particles.

It will also be understood from the foregoing that the corrugations 78 serve to increase the circulation of the refrigerant gas and hence the cooling of the motor 16 is materially increased. Also gas passing upwardly through the clearance space between the rotor 34 and stator 36 and through the openings 76 will reflect any overheating of the motor, and since such gas is directed to the thermal conducting ring 62, the overload protection switch 58 will be more sensitive in protecting the motor in the event of overload conditions.

While a preferred embodiment of the invention has been shown herein and described with considerable particularity, it will be understood by those skilled in the art that various modifications may be made without departing from the spirit of the invention. Reference will therefore be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In a compressor unit of the hermetically sealed type having a housing provided with an inlet connection for discharge of low pressure gaseous refrigerant into the interior of the housing and having an outlet connection for discharge of compressed gaseous refrigerant from the housing, a compressor within the housing for delivering compressed refrigerant to said outlet, a vertically arranged rotatable shaft connected to and rotated coincidentally to the operation of said compressor, said shaft having its upper end terminating adjacent the top of said housing, the interior of the housing forming a lubricant reservoir at the bottom thereof, at least one suction tube for delivering low pressure gaseous refrigerant to said compressor, said tube having an open inlet positioned closely adjacent the upper end of said shaft, and an anti-slugging device connected to the upper end of said shaft for rotation thereby to separate liquid refrigerant and oil from gaseous refrigerant, said device comprising a dish-shaped circular plate positioned closely adjacent to and below the open inlet of said tube, and said plate having a plurality of openings which are successively substantially vertically aligned, during rotation of said shaft and plate, with said tube inlet, said plate being formed with a hub portion connected with said shaft, a laterally directed rim portion, and an upwardly directed cone-shaped portion connecting the hub and rim portions, said plurality of openings being formed in said cone-shaped portion for conducting gaseous refrigerant from beneath the plate to said tube inlet.

2. The compressor unit as claimed in claim 1 wherein said rim portion is corrugated throughout its peripheral extent.

3. In a compressor unit of the hermetically sealed type having a housing provided with an inlet connection for discharge of low pressure gaseous refrigerant into the interior of the housing and having an outlet connection for discharge of compressed gaseous refrigerant from the housing, a compressor within the housing for delivering compressed refrigerant to said outlet, a vertically arranged rotatable shaft connected to and rotated coincidentally to the operation of said compressor, said shaft having its upper end terminating adjacent the top of said housing, the interior of the housing forming a lubricant reservoir at the bottom thereof, at least one suction tube for delivering low pressure gaseous refrigerant to said compressor, said tube having an open inlet positioned closely adjacent the upper end of said housing, and an anti-slugging device connected to the upper end of said shaft for rotation thereby to separate liquid refrigerant and oil from gaseous refrigerant, said device comprising a disc having a hub portion secured to the shaft, a laterally directed rim portion and an upwardly directed cone-shaped body portion connecting said hub and rim portions, the rim portion of the disk being corrugated throughout its peripheral extent.

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Disclaimer

3,104,051.—*John Henning* and *Carl W. Hobgood*, Evansville, Ind. ANTI-SLUGGISH DEVICE FOR MOTOR-COMPRESSOR UNITS. Patent dated Sept. 17, 1963. Disclaimer filed Jan. 31, 1975, by the assignee, *Americold Compressor Corporation.*

Hereby disclaims the remaining term of the patent subsequent to Dec. 31, 1974.

[*Official Gazette May 13, 1975.*]