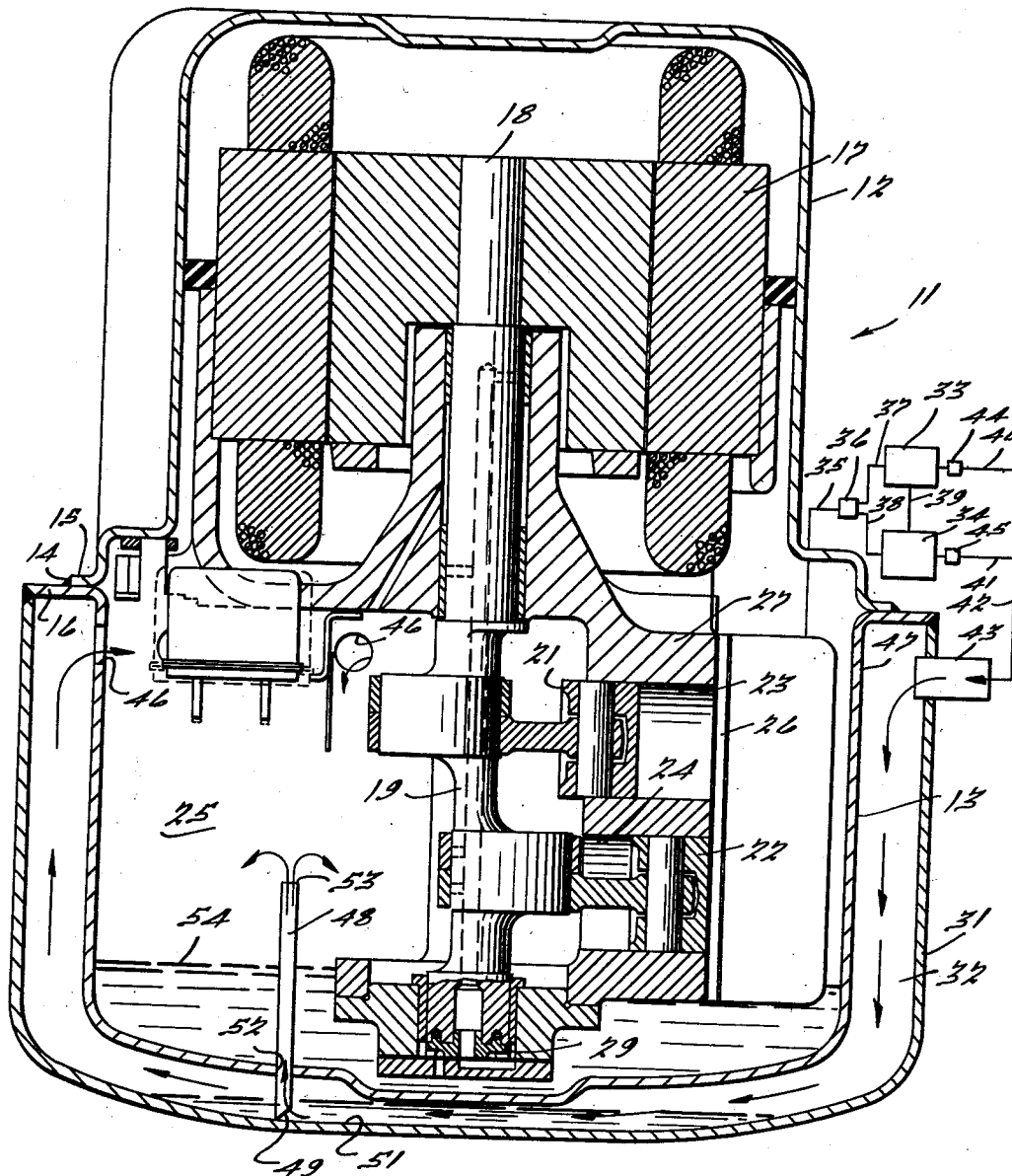


Jan. 15, 1963

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HERMETIC COMPRESSOR ASSEMBLY FOR HEAT
PUMP APPLICATION
Filed March 2, 1960

3,073,515



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HERMETIC COMPRESSOR ASSEMBLY FOR HEAT PUMP APPLICATION

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Filed Mar. 2, 1960, Ser. No. 12,434

1 Claim. (Cl. 230-206)

This invention relates to compressor assemblies especially adapted for heat pump applications, and more particularly to improved means for preventing refrigerant slugging from harming compressor parts.

Refrigerant slugging problems in heat pump systems arise from the fact that the condenser and evaporator coils are reversible in function. Particularly, when the system is suddenly reversed for the defrost cycle, the condenser holding some liquid refrigerant becomes an evaporator, and the liquid refrigerant is suddenly blown into the compressor or its environs.

It is an object of the present invention to provide a novel and improved construction for trapping such liquid refrigerant in such a manner as to prevent any harmful effect on the compressor and to facilitate evaporation of the trapped liquid so that it may re-enter the system.

It is another object to provide an improved construction of this nature which utilizes the crankcase heat for evaporating the trapped refrigerant, and in which the lowered crankcase pressure is made use of to return to the crankcase the lubricant which had entered the refrigerating system.

It is a further object to provide an improved compressor construction of this nature which is extremely simple and compact as well as reliable in performance.

Other objects, features, and advantages of the present invention will become apparent from the subsequent description, taken in conjunction with the accompanying drawings.

The FIGURE is a partially schematic side elevational view in cross-section of a hermetic compressor assembly incorporating the novel features of this invention.

In general terms, the illustrated embodiment of the invention comprises a hermetic compressor assembly having an upper housing portion containing the electric driving motor and a crankcase portion therebelow which encloses the compressor cylinders and crankshaft. A jacket is secured to and surrounds the crankcase, a plurality of ports being formed around the upper portion of the crankcase and connecting the crankcase chamber to the chamber formed by the crankcase and jacket. A connection is provided leading from the upper portion of this jacket chamber to the coil of a heat pump system which acts as the condenser during the refrigerating portion of the cycle and as an evaporator during the defrost portion. When the defrost cycle is started, slugs of liquid refrigerant will enter the jacket chamber from this connection and will be trapped in the lower portion of the jacket chamber, the gaseous refrigerant entering the crankcase chamber through the first-mentioned ports. The heat flowing from the crankcase chamber through the crankcase will warm the liquid refrigerant until it evaporates, rises and enters the crankcase chamber through the upper ports. A vertical oil return tube is mounted in the lower portion of the crankcase, the lower end of this tube being adjacent the bottom of the jacket chamber, the upper end being above the crankcase oil level. The reduced pressure in the crankcase will cause oil settling in the bottom of the jacket chamber to be drawn upwardly through the tube over a period of time, thus returning lubricant entrained in the refrigerating system to the crankcase.

Referring more particularly to the drawing, the hermetic compressor unit is generally indicated at 11 and com-

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prises an upper housing 12 of generally inverted cup shape and a metal crankcase 13 of upwardly facing cup shape, these two housing portions being united by welding 14 or other means along mating flanges 15 and 16 respectively. Housing 12 contains an electric motor 17 which drives a shaft 18 connected to a crankshaft 19 vertically disposed within crankcase 13. The crankshaft drives pistons 21 and 22 disposed within cylinders 23 and 24 respectively, refrigerant gas being drawn from crankcase chamber 25 into the cylinders and discharged into the refrigerating system under the control of valves (not shown) in a member 26 secured to compressor housing 27. A compressor oil pump 29 is disposed at the lower end of crankshaft 19 and is adapted to pump oil from the lower portion of crankcase chamber 25 to the various bearings. A cup-shaped jacket 31 is secured to the outer edge of flange 16 and surrounds crankcase 13 in spaced relation therewith, thereby forming a collection chamber 32.

The novel hermetic compressor unit is shown in conjunction with a schematically illustrated heat pump system including first and second coil elements 33 and 34 connected to the discharge of the compressor 11 by a conduit 35 and a selectively actuatable valve 36 which is capable of directing the compressed refrigerant gas either to coil element 33 through a conduit 37 or coil element 34 through a conduit 38. A conduit 39 connects units 33 and 34. The discharge ends of coil elements 33 and 34 are connected by conduits 40 and 41 respectively to a common conduit 42, the latter conduit being connected to a port 43 leading into the upper portion of chamber 32. A pair of selectively actuatable valves 44 and 45 are disposed in conduits 40 and 41 respectively.

The upper portion of crankcase 13 is provided with a plurality of circumferentially spaced ports 46 connecting chamber 32 with crankcase chamber 25. These ports are of sufficient area to permit free flow of refrigerant gases which enter chamber 32 from port 43 or which are evaporated from the liquid refrigerant collecting in chamber 32. The portion 47 of crankcase 13 opposite port 43 is not provided with a port 46, so that no slugs of liquid refrigerant entering chamber 32 may pass directly into chamber 25.

An oil return tube 48 is vertically disposed in the bottom of crankcase 13, this tube being of relatively small diameter to provide a restricted passage leading from chamber 32 to chamber 25. The lower end 49 of tube 48 is of tapered shape, and extends close to the bottom of chamber 32 adjacent inner surface 51 of the portion of jacket 31. The tube extends through an apertured portion 52 in crankcase 13, and mouth 53 of the tube at its upper end is a substantial distance above the normal level 54 of oil in the crankcase.

In operation, assuming an initial condition in which valve 36 is so adjusted as to discharge compressed gas to coil element 33, with valve 44 closed and valve 45 open, element 33 will act as a condenser with the refrigerant flowing through conduits 41 and 42 to port 43. The refrigerant gases entering the upper portion of chamber 32 will pass through ports 46 into crankcase 25 from where they will be withdrawn into pressure cylinders 23 and 24 and compressed, exiting through conduit 35. Liquid slugs of refrigerant or oil will drop to the bottom of chamber 32 and will collect there.

Heat flowing from crankcase chamber 25 through crankcase 13 will warm this liquid refrigerant collected in the bottom of chamber 32 so that the refrigerant will evaporate, rise and pass through ports 46. This flow will be aided by the pressure reduction in crankcase 25 due to the intake of the compressor. The pressure re-

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duction will also cause oil to be drawn up through tube 48 from the bottom of chamber 32, where it will collect this oil thus being returned to the crankcase.

Should the cycle be reversed by switching valve 36 to cause flow into conduit 38, closing valve 45 and opening valve 44, the compressed gas will flow from conduits 35 and 38 through coil element 34, conduit 39, coil element 33 and conduits 40 and 42 to port 43. Coil element 34 which had previously acted as an evaporator will now act as a condenser while coil element 33, which has previously acted as a condenser will now act as an evaporator. Slugs of refrigerant fluid remaining in coil element 33 from the previous portion of the cycle will thus be discharged to chamber 32 along with gaseous refrigerant. This liquid refrigerant will be trapped in chamber 32 and will collect there, being warmed by the heat flowing from the crankcase chamber through crankcase 13. The liquid refrigerant will thus be prevented from entering the compressor cylinders, but will evaporate, rise and flow through ports 46 to chamber 25. At the same time, oil collected in chamber 32 will continue to be drawn upwardly through return tube 48 by reason of the reduced pressure in chamber 25.

It should be noted that although some liquid refrigerant might possibly pass upwardly through tube 48, the diameter of this tube is sufficiently small to prevent substantial flow. Since the oil may satisfactorily be returned to the crankcase over a longer period, tube 48 will thus serve as an efficient oil return conduit.

While it will be apparent that the preferred embodiment of the invention disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and

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change without departing from the proper scope of fair meaning of the subjoined claim.

What is claimed is:

In combination, a refrigerant compressor, a compressor inlet chamber formed by a first jacket surrounding said compressor and having a bottom and a side wall, a compressor oil pump disposed in the lower portion of said compressor inlet chamber, a second jacket having a bottom and a side wall surrounding and spaced from the bottom and side wall of said first jacket and forming a refrigerant collecting chamber in heat transfer relation with said first jacket, an oil return tube of relatively small diameter extending upwardly from adjacent the bottom of said refrigerant collecting chamber through the bottom of said first jacket, the top of said oil return tube being disposed in an intermediate portion of said compressor inlet chamber, a connection in said second jacket for permitting refrigerant returning from a refrigerating system to enter the upper portion of said refrigerant collecting chamber, and passageways means spaced from said last mentioned connection and passing through said first jacket for permitting vaporized refrigerant to pass from the upper portion of said refrigerant collecting chamber to said compressor inlet chamber.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,073,515

January 15, 1963

Emil T. Neubauer et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 21, for "schematiacilly" read
-- schematically --; column 4, line 20, for "passageways"
read -- passageway --.

Signed and sealed this 6th day of August 1963.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents