ABSTRACT OF THE DISCLOSURE

An improved compressor block assembly for a hermetic compressor comprising three concentric walls cast integrally with a base to form a lower portion of the compressor block and a separate plate member including a sleeve-like member cast integrally therewith secured to the top of the lower portion. An unobstructed annular space is formed between the outer and middle walls of the compressor block. A cylindrical discharge gas muffler having baffles therein is disposed in the annular space to provide a circuitous path for muffling the discharge gas during operation of the compressor.

BACKGROUND OF THE INVENTION

Large refrigerant compressors for commercial and industrial use have commonly been of the type termed in the refrigeration industry as “semi-hermetic” (bolted-together type). Such compressors comprised compression mechanism which included a very heavy and large cast iron block machined to define cylinders for receiving reciprocating pistons. The pistons were operatively connected to a crankshaft journalized in the compressor block. The electric motor for driving the crankshaft was outside of the cast iron block. Fabrication of complicated internal passageways within the cast iron block for a discharge gas muffling chamber was not possible due to coring problems and almost impossible cleaning of these cored passageways. Attempts to create this style of compressor always resulted in large heavy compressors with very minimum results in discharge gas muffling. For example, see C. R. Neeson Patent 2,247,449 of July 1, 1941; C. R. Neeson Patent 2,203,510 of June 11, 1940; P. F. Berry Patent 2,073,547 of Mar. 9, 1937 and C. R. Neeson Patent 2,269,841 of Feb. 19, 1945.

More recently, vertical shaft refrigerant compressors, as used in light commercial and light industrial use, have been comprised of compression mechanism and an electric motor supported within an outer hermetically-sealed housing. The compression mechanism included a cast iron block machined to define cylinders for receiving reciprocating pistons. The pistons were operatively connected to an upright crankshaft disposed within the block. As described above, in the semi-hermetic compressor fabrication of complicated internal passageways within the cast iron block for a discharge gas muffling chamber was not possible due to inherent problems in design including maintenance of desired wall thickness and due to coring problems inherent in the casting process. To facilitate forming an annular discharge gas cavity within the compression mechanism, suitable flanges were formed on the exterior of the compressor block, and the cast iron compressor block was shipped telescopically into an annular sheet metal sleeve so as to define a discharge gas cavity between the exterior of the compressor block and the interior of the sleeve. Since the compressor block did not have an outer wall integral therewith, ribs and flanges could be readily formed on the exterior of the block during casting. Examples of such compressor block in prior patents are found in Gerteis Patent 3,008,628

SUMMARY OF THE INVENTION

The present invention relates to a hermetic refrigerant compressor, and more particularly, to a hermetic refrigerant compressor having a compressor block formed of cast iron. The block is formed basically of three concentric wall members integrally joined by a base portion. Radially-disposed cylinder bores are formed within the concentric wall members for receiving cylinder liners. The tops of the passageways defined in the compressor block between the inner and middle wall respectively and between the middle and outer wall members respectively are closed by a top plate member. Extending upwardly from the top plate member is an annular sleeve-like portion for receiving the electric drive motor of the compressor. Another feature of the present invention is the provision of simplified discharge gas muffling means within the annular discharge gas cavity defined in the annular space between the middle and outer wall members and an unobstructed generally sized suction annulus formed by the inner and middle wall of the compressor block.

BRIEF DESCRIPTION OF THE DRAWING

The objects and features of this invention will become more apparent from the description which follows when read in conjunction with the accompanying drawing, in which:

FIG. 1 is a longitudinal cross-sectional view of a hermetic refrigerant compressor embodying the present invention;

FIG. 2 is a plan view of the lower portion of the compressor block of the refrigerant compressor shown in FIG. 1;

FIG. 3 is a longitudinal cross-sectional view of the lower portion of the compressor block taken generally along the line 3—3 of FIG. 2;

FIG. 4 is a plan view of the discharge gas muffling sleeve; and

FIG. 5 is a layout of the discharge gas muffling sleeve.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is illustrated a hermetic refrigerant compressor assembly 10 embodying the present invention. The compressor assembly 10 comprises a hermetically-closed outer housing or casing formed by a lower cup-shaped shell 11 and an upper cup-shaped shell 12 interconnected by an intermediate sleeve portion 13. The shell and sleeve portions 11, 12 and 13 may be fabricated of sheet metal and suitably joined, as for example, by welding. To the bottom of the lower shell 11 are secured a plurality of mounting feet 14 for suitably supporting the compressor assembly for use.

Resiliently supported within the outer housing by spring means 15 is a compression mechanism indicated generally by the numeral 16. The compression mechanism 16 includes a unique compressor block construction. The block comprises a lower portion defined by a plurality of concentric sleeve or wall portions 17, 18 and 19 formed integrally with a base portion 20. Defined between the inner and middle wall portions 17 and 18 is an annular passage 22 and defined between the middle and outer wall portions 18 and 19 is an annular passage 23. The sleeve portions 17, 18 and 19 are cast integrally and define three annular sections of internal passageway, each section being provided with a discharge gas muffling chamber 24. The compressor block 17, 18 and 19 comprises an inner cylinder bore 25, the discharge gas passage 26 and the suction gas passage 27. The cylinder bores 25 and passages 26 and 27 are radially disposed with annular spaces 28, 29, 30 and 31 formed between the middle wall portion 18 and the sleeve portions 17 and 19. The passages 26 and 27 are connected to the cylinder bores 25 through annular passages 32 and 33 formed between the middle wall portion 18 and the outer wall portion 19. A discharge gas muffling chamber 34 is formed between the middle and outer wall portions 18 and 19. A suction gas muffling chamber 35 is formed between the outer wall portion 19 and the inner cylinder bore 25. Discharge gas passages 36 and 37 are formed between the discharge gas chamber 24 and the muffling chambers 34 and 35, respectively. A discharge gas muffling chamber 38 is formed between the inner cylinder bore 25 and the inner wall portion 17. A suction gas muffling chamber 39 is formed between the cylinder bore 25 and the outer wall portion 19. Passage 40 is formed between the suction gas chamber 35 and the muffling chamber 39. Passage 41 is formed between the discharge gas chamber 24 and the muffling chamber 34.
portions 18 and 19 respectively is a substantially annular passage 24. The lower portion of the compressor block is made from a cast iron casting.

The upper portion of the compressor block is comprised of top plate members 26, 30, and 32 extending upwardly from the top plate portion is a sleeve-like portion 28 for receiving the electric drive motor for the crank shaft disposed in the compression mechanism. The top plate portion closes the upper end of annular passage 24. Openings 30 are provided in the top plate member 26 for connecting the electric drive crank shaft to the upper portion of the annular passage 22. Formed centrally in the top plate member 26 is a hub or upper bearing 32.

Secured to the lower portion of the compressor block is a lower bearing 34 which is retained in place within the compressor block by a suitable retaining ring 36. Bearing liners 38 and 39 are provided in the upper bearing 32. A bearing liner 40 is provided in bearing 34. Journalled within bearing liners 38, 39, and 40 is a vertically disposed drive shaft or crank shaft 42 which is operatively keyed or otherwise connected at its upper end to the motor shaft of the electric drive crank shaft 44. The motor stator 48 is fixed within the sleeve-like portion 28 of the compressor block.

A plurality of radially-disposed cylinder means 50 are provided in the wall portions 17, 18, and 19 of the compressor block. Within the cylinder means 50 are reciprocating rod and pistons 52 that are each operatively connected to the eccentric portion of the crank shaft 42 by means of a connecting rod 54.

The cylinder means 50 are each comprised of an annular sleeve-like cylinder liner 56 disposed in an opening within the inner wall portion 17. The cylinder liner 56 includes a substantially uniform wall thickness cylindrical portion joined at the outer end to an enlarged flange-like portion, so as to define a step on the exterior of the cylinder liner 56 intermediate the ends of the cylinder liner. The step on the cylinder liner is adapted to engage within a corresponding stepped opening in the wall 17 of the compressor block to properly orient the liner in the block.

Abutting the outer end of the cylinder liner 56 is the discharge and suction valve assembly 58. The discharge and suction valve assembly 58 is like that shown in Parker Patent 3,272,426, granted Sept. 13, 1966, and reference may be made to such patent for a fuller explanation of the details of such discharge and suction valve assembly. The discharge and suction valve assembly 58 is mounted in position against the end of the cylinder liner 56 by a cylinder head member 60. The cylinder head member 60 is held in place by means including a Belleville spring 62 and a retaining ring 64. The Belleville spring exerts a force inwardly against the discharge and suction valve assembly 58 to urge same into sealing relationship with the outer end of the cylinder liner 56.

The cylinder head 60 includes a pair of annular flange-like portions, each of which has a peripheral recess that receives an O-ring 70 and 71, respectively. The O-ring 70 cooperates with the intermediate wall portion 18 of the compressor block to form a seal between the annular passageways 22 and 24. The O-ring 71 functions to provide a seal between the discharge gas in the annular discharge gas cavity 24 and the suction gas in the space between the compression mechanism and the outer housing. Counterweight portions 65 and 68 are provided on the crank shaft 42. The counterweight portions, as shown, are separate members secured to the crank shaft 42. The counterweight 68 is provided with a radial passage 67 which communicates with a passage 69 in the base portion 20 of the compressor block for removing oil during operation of the compressor block for returning oil during operation of the compressor block to the oil sump defined between the compression mechanism 16 and the lower shell portion 11.

The compression mechanism 16 is resiliently supported in the outer housing by spring arrangement 15 which may include a mounting support of annular ring 80, a plurality of upright studs 81 each disposed between the mounting support 80 and an associated opening adjacent the periphery of the plate portion 26, and nuts 82 at the ends of the stud member 81. Provided between the top plate portion 26 and the mounting support 80 is a spring 83 for biasing the compression mechanism upwardly away from the mounting ring so as to resiliently support the compression mechanism within the compressor. A spring guide sleeve 84 is carried on the stud between the stud and the spring member 83. The opening 85 in the plate member 26 receives the stud 81 therethrough and abuts the spacer 87.

Within the outer annular space 24 which defines a discharge gas cavity is a discharge gas muffler 90, which muffler is an important aspect of the present invention. This will be considered more fully hereinafter.

Referring now to FIGS. 2 and 3, there is better illustrated the construction of the lower portion of the compressor block. The compressor block illustrated is for a 12 cylinder reciprocating compressor and the numerals on FIG. 2 are used to indicate the relative positions of the cylinders in the compressor block. It will be understood to those having skill in the art that the compressor may be provided with more or less cylinders dependent upon design requirements. The flange-like portions 17a and 19a extending inwardly from the wall portion 17 and outwardly from the wall portion 19, respectively, are provided for securing the top plate member 26 to the lower portion of the compressor block so as to complete the compressor block assembly. As shown in FIG. 1, machine bolts 31 extend through aligned openings in the top plate 26 and the flanges 17a and 19a on the inner and outer wall portions for securing the upper portion to the lower portion of the compressor block. O-ring seals 33 are provided in each of the recesses 33 in the top portions of each wall member 17, 18, and 19, respectively, to seal between the mating surfaces of the upper and lower portions of the compressor block.

As best seen by reference to FIGS. 1 and 3, the cylinder liners 56 may be readily positioned within the compressor block form exterior of the compressor block. The opening in the outer wall portion 19 is larger than the opening in the inner wall portion 17 and thus, the cylinder liner 56 may readily be inserted through the outer wall portion 19 and the middle wall portion 18 until the stepped flange portion on the liner abuts the surface 92 of the inner wall portion 17. The discharge and suction valve assembly 58 is then positioned with the end of the cylinder head member 60 is disposed within the openings in the middle wall portion 18 and 19. The cylinder head is secured in place by the retaining means 62, 64.

Referring now to FIGS. 4 and 5, there is illustrated another feature of the present invention. This feature is the provision of a sleeve-like discharge gas muffling sleeve which is readily inseretable into the annular space 24 for muffling the discharge gas during operation of the compressor. The discharge gas muffler includes a plate member or sleeve 102 which may be formed of sheet metal and is adapted to be rolled so as to define a cylinder. The ends are suitably joined as indicated externally to the sleeve 102 are a plurality of elongated segments 103 which define baffles for causing the gas to pass through the discharge gas muffling chamber 24 in a circuitous route. The baffles are each comprised of elongated generally of W or V-shaped portions of metal extending axially of the compressor and spaced from one end 104 to the sleeve 102 and being free at the other end 105. The baffles are of different lengths and are staggered in position so as to provide a circuitous route for the passage of discharge gas in space 24. Provided in the sleeve 102 are a plurality of openings 108 which conform in size to the openings in the outer wall portion 19 for receiving the cylinder head 60 therein.

As aforementioned, in some constructions the discharge gas muffling chamber was defined in part by portions cast.
into the compressor block. A separate sheet metal sleeve cooperated with the cast block to define the discharge gas muffling chamber. The present design provides a simplified casting which incorporates an annular space therein. The annular cavity or space 24 is free from obstructions and can readily receive the cylindrical muffler sleeve 102.

To assemble the discharge gas muffler, the baffles 103 are secured to the sleeve 102 to form a subassembly. The subassembly is inserted into the annular discharge cavity 24 in the compressor block prior to joining the top wall portion 26 to the lower portion of the compressor block. The sleeve 102 is positioned in the annular discharge gas cavity 24 so that the openings 108 therein are in alignment with the respective openings in the wall portions 18 and 19. Then the cylinder heads 48 are inserted into the openings in the wall portions 18 and 19 and through the openings 108 in sleeve 102. Since the baffles 103 are secured only at one end, there is some inherent resiliency such that the outer portion of the baffles 103 will tend to be against the inner surface of the outer wall portion 19 so as to provide an effective seal between the outer portion of the baffle and the cooperating and abutting inner surface of the outer wall portion 19. Therefore, the discharge gas passing through the passages in each cylinder head into the discharge gas cavity 24 will flow in a circuitous route through the discharge gas cavity until it passes into the discharge line for discharge from the refrigerant compressor.

The operation of the compressor is believed evident from the foregoing and will only be briefly described hereinafter. Suction gas enters the space between the compression mechanism 16 in the outer housing through a suction line (not shown). The suction gas passes through the opening in the upper end cap 45 over the motor 44 for cooling same and into the passageway 22. The suction gas is compressed by the movement of the piston 52 within the cylinder means 50, and the discharge gas passes through the cylinder head 60 into the discharge gas muffling chamber 68. The discharge gas passes through a circuitous route in the discharge gas cavity 24, which is provided by the discharge gas muffler sleeve 102. From the discharge gas cavity 24, the discharge gas passes into a discharge line (not shown) for forwarding to the condenser in a refrigeration system.

There has been provided by the present invention a unique cast iron compressor block construction which permits of ready fabrication and assembly of the compression mechanism in a hermetic compressor. The compressor block includes a lower portion comprised of three concentric sleeves connected integrally with a base portion and an upper portion including a separate plate member secured to the lower portion. Defined within the compressor block is a substantially unobstructed annular discharge gas space into which is adapted to be inserted telescopically a discharge gas muffler sleeve for defining a discharge gas cavity 24 for muffling the discharge gas passage through it.

While a presently preferred embodiment of the invention has been described and illustrated, it should be understood that the invention is not limited thereto but may be otherwise embodied within the scope of the following claims.

What is claimed is:

1. In a refrigerant compressor comprising compression mechanism supported within an outer sealed casing, the improvement comprising said compression mechanism comprising a compressor block including three concentrically formed inner, middle and outer wall members integrally disposed, said outer wall member being defined between the middle and outer wall members an annular longitudinally elongated space, and there being longitudinally extending passage means formed between the inner and middle wall members, a separate plate member secured to the end of said compressor block opposite the base member, said plate member having openings therein in alignment with the passage means, cylinder means disposed within the compressor block and communicating with said space and said passage means, piston means in the cylinder means, with suction gas entering the compressor block and passing through said passage means into said cylinder means and being compressed therein, the compressed discharge gas passing into said annular space between the middle and outer wall members which defines a discharge gas cavity.

2. A refrigerant compressor as in claim 1 wherein said plate member includes an integrally formed sleeve portion extending outwardly from the plate member and defining a housing for receiving and supporting an electric drive motor.

3. A refrigerant compressor as in claim 2 wherein first bearing means are supported centrally in said plate member and second bearing means are supported in the base portion of said compressor block, and a crank shaft journal in said bearing means, said crank shaft being operatively connected to and driven by the electric motor and being operatively connected to the piston in the cylinder and piston means for driving same.

4. A refrigerant compressor as in claim 1 wherein said compressor block is cast.

5. A refrigerant compressor as in claim 4 wherein the compressor block and plate member are bolted to one another.

6. A refrigerant compressor as in claim 1 wherein said elongated space is generally unobstructed for receiving a cylindrical discharge gas muffler sleeve.

7. A refrigerant compressor as in claim 6 wherein said discharge gas muffler sleeve comprises a cylindrical plate member having a plurality of baffles thereon for providing a circuitous path for discharge gas passing through the discharge gas cavity.

8. A method of assembling a refrigerant compressor including a compressor block having at least a pair of annular walls defining an inlet into an unobstructed, annular space, with aligned openings in said walls, comprising the steps of inserting an annular sleeve having a plurality of baffles thereon through said inlet into said space for providing a circuitous path for gas passing through said space, with openings in said sleeve being in alignment with said aligned openings in said walls, inserting cylinder means into said aligned openings in said walls and a selected aligned opening in said sleeve, retaining said cylinder means in place in said walls, and joining a plate member to said walls to close the inlet to said space.

9. For use in a refrigerant compressor having a substantially unobstructed space between a pair of annular wall portions, a discharge gas muffler comprising a cylindrical sleeve member having a plurality of baffles thereon for providing a circuitous path for discharge gas passing through said space, there being openings in said sleeve member adapted to receive cylinder means of said compressor therein.

10. A device as in claim 9 wherein the baffles are each comprised of generally U-shaped members in cross section extending axially of the sleeve member and secured to the sleeve member only along one end, the baffles being of different length and being staggered so as to provide a circuitous path for discharge gas through said space.

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