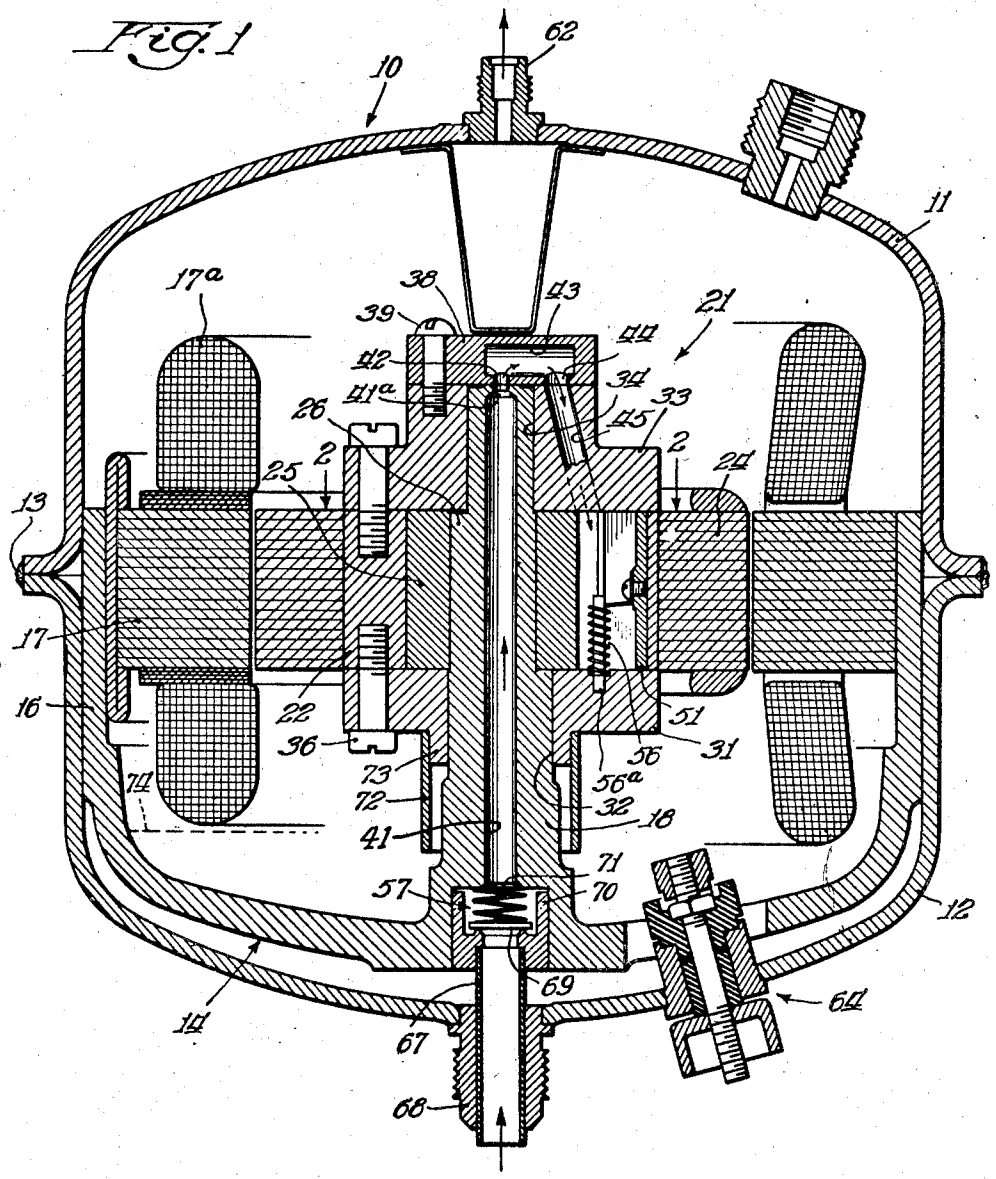
Jan. 28, 1947. E. F. HUBACKER 2,415,011

MOTOR COMPRESSOR ASSEMBLY

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Fig. 1



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Fig. 2

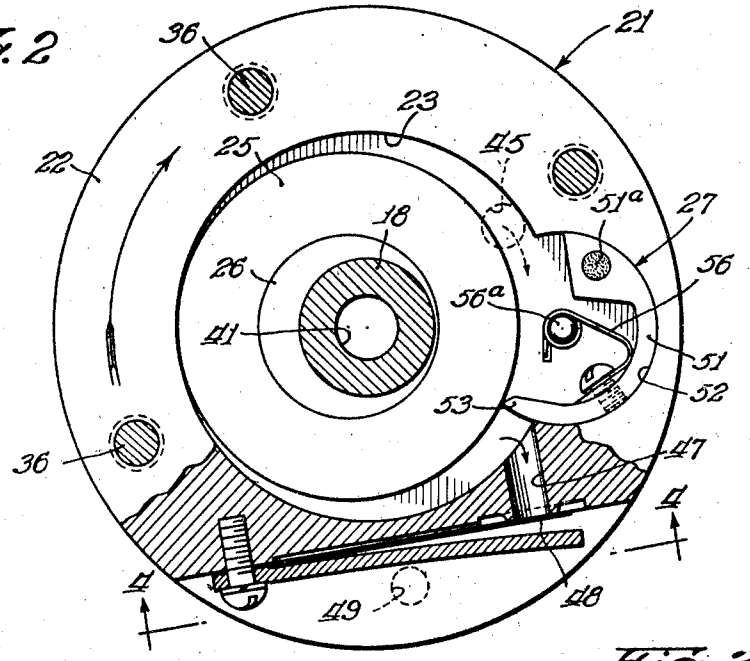


Fig. 3

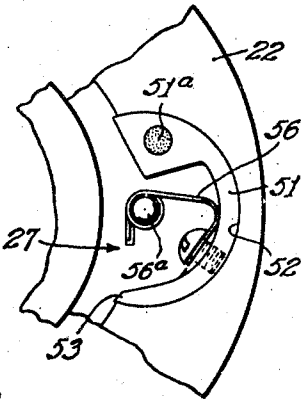
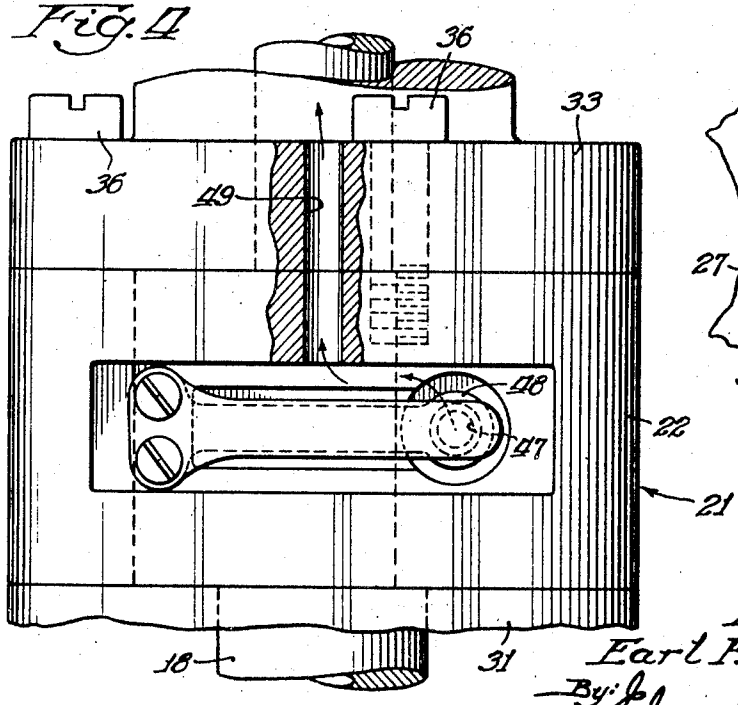


Fig. 4



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UNITED STATES PATENT OFFICE

2,415,011

MOTOR COMPRESSOR ASSEMBLY

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Application September 18, 1942, Serial No. 458,891

4 Claims. (Cl. 230—139)

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This invention relates to motor compressor units and particularly to an improved arrangement having special application as a refrigerant compressor.

It is a general object to provide an improved arrangement of elements forming a sealed housing compressor assembly having the minimum overall coaxial dimension while maintaining a high efficiency of operation and effecting a reduction in the cost of manufacture over that of similar units of present manufacture.

It is an object to accomplish the above by a special arrangement of unloading valve structure operable in response to a predetermined speed of rotation to thus lower the required starting torque of the motor compressor unit and consequently make it possible to effect an economy in the weight and material required in the construction of the unit.

It is a more detailed object to provide in a motor compressor unit of the above type an improved lubricating arrangement for insuring the delivery of the necessary lubricant to each of the vital moving parts.

It is another particular object to provide in a motor compressor unit of the above type a special arrangement of bearings which will effect an improved distribution of bearing load and hence reduce the required capacity of the individual bearing.

It is still another object to provide an arrangement for taking advantage of the reaction effect of the discharge gases and further reducing the power requirements of the motor with a consequent reduction in cost and increase in efficiency.

Another detailed object is the provision of the above-described compact arrangement of elements making it possible to employ identical dome stampings comprising the sealed housing thus eliminating the extra cost involved in providing two different shapes and sizes of stampings as well as making it possible to reduce the overall height of the refrigerator cabinet and compressor assembly forming the complete refrigerator unit.

Other and more particular objects, advantages and uses of my invention will become apparent from a reading of the following specification taken in connection with the accompanying drawings forming a part thereof and wherein—

Fig. 1 is a coaxial cross-section view of a compact motor compressor unit forming a preferred embodiment of my invention and bringing out to particular advantage the location of the compressor within the axial confines of the motor rotor and stator windings;

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Fig. 2 is a broken-away cross-section view taken substantially on the line 2—2 of Fig. 1 and bringing out to advantage the particular relation of the rotating compressor cylinder, the embraced eccentric about which the cylinder rotates and particularly the centrifugally responsive divider unloading valve structure;

Fig. 3 is a broken-away cross-section view of the structure including and associated with the centrifugally responsive divider unloading blade and showing the blade in the unloading position;

Fig. 4 is an elevation view taken substantially on the line 4—4 of Fig. 2 with certain of the structure broken away bringing out to particular advantage the operation of the compressor discharge valve as well as the passage in the rotating compressor cylinder for conveying the compressed refrigerant to the dome of the compressor.

Referring in greater detail to the figures of the drawings, 10 indicates generally a refrigerant motor compressor unit including a pair of identical dome stampings 11 and 12 formed of sheet metal and requiring but a single set of dies. These stampings may be fastened together as by welding at 13. Received within the dome members 11 and 12 is a motor and compressor supporting bowl-like frame indicated generally at 14 which may be a casting and which is given a pressed fit within the dome members. Frame member 14 includes side portions 16 embraceably receiving the stator laminations 17 of the motor and windings 17a carried thereby, said frame further including a coaxially extending shaft 18 supporting the combination motor rotor and compressor indicated generally at 21 for rotation thereabout as will appear.

This combination motor rotor and compressor unit 21 in its construction and arrangement forms a particular part of the present invention. A rotatable annular ring 22 is formed therein with a compressor cylinder 23. Mounted on the external periphery of ring 22, as by means of a pressed fit, are a plurality of motor rotor laminations 24 having the function of cooperating with the stationary field laminations and windings and effecting the rotation of the annular ring 22. The inner periphery 23 of this rotatable ring or the compressor cylinder embraces a ring 25 which in turn rotates about an eccentric 26 formed on the vertical supporting shaft 18, this eccentrically mounted ring 25 being further arranged for engagement by the blade of a spe-

cially constructed centrifugally responsive divider assembly indicated generally at 27. The lower terminal portion of the cylindrical bore 23 may be closed by a plate 31 having a bearing 32 rotatably mounted on shaft 18 and the upper terminal portion of said cylindrical bore may be closed by a plate 33 similarly provided with a bearing 34 rotatably mounted on shaft 18, the plates 31, 33 and the cylinder 22 being held in assembled relation as by cap screws 36. A bearing plate 38 is fastened to upper closure plate 33, as by threaded cap screws 39 (only one screw being shown) and engages the upper end of shaft 18 to form a supporting bearing for the assembly 21 on the upper end of shaft 18, this shaft being formed internally with a coaxial bore 41 having a restricted outlet portion 41a cooperating with a port 42 in the bearing plate 38 to form a seal therebetween. Port 42 communicates through a transverse passage 43 and a second port 44 with a downwardly extending passage 45 in upper closure plate 33 leading into the compressor cylinder 23 in the area on one side of the divider assembly 27. On the opposite side of the divider assembly 27 passage 47 in rotating cylinder 22 leads to a pressure responsive discharge valve 48 and thence through a second vertically extending passage 49 in cylinder 22 and closure plate 33 into the dome 11.

While I have shown and described the compressor body or housing proper as being made up of rotatable ring 22 and end closure plates 31 and 33, this being a preferred arrangement, it will be understood that the compressor body may be formed in other ways coming within the broad scope of my invention. The important thing to be remembered insofar as the broader aspect of the present invention is concerned is that the compressor body and motor rotor form a single assembly, the compressor body being located within the motor rotor at the same axial position or in radially opposed relation, to thus render the assembly more compact by reducing the overall axial dimension thereof as well as incorporating the further advantage flowing from the location of bearings 32 and 34 on opposite sides of the compressor cylinder.

It will be further understood that while I have shown and described the eccentric means as made up of the circular ring 25 rotatably mounted on the eccentric 26 embraced thereby, and prefer this arrangement in actual practice, this eccentric means may comprise only the eccentric 26 enlarged to the size of ring 25, eliminating ring 25 and still come within the broader aspect of my invention.

Divider assembly 27 includes a segmental member 51 oscillatable within an arcuate recess 52 formed within the inner periphery 23 of rotatable ring 22 and having a blade-like portion 53 movable into contact with eccentrically mounted ring 25 in response to the arcuate adjustment of segmental member 51. It is important to note that the weight of said segmental member 51 is so distributed that the centrifugal force acting as a result of rotation of the supporting ring 22 is effective to move blade-like portion 53 in the direction of engagement with ring 25 with a torque that increases as the speed of rotation of ring 22 increases. This tendency of centrifugal effect is counteracted by the provision of a spring 56 tending to turn the segmental member 51 in the opposite or counterclockwise direction about pin 56a as viewed in Fig. 2.

There are a number of ways in which the weight distribution making up arcuate member 51 may be effected, including removing metal from the portion of the arcuate member on the side of the axis thereof adjacent blade-like portion 53 or, alternatively, adding weight to the opposite portion of arcuate member 51 as by boring a hole or holes therein and replacing the same with a metal having a higher specific gravity than that of the metal forming member 51, this latter method being indicated on the drawings at 51a.

In operation it will thus be seen that refrigerant from the evaporator is drawn into the compressor through a check valve assembly indicated generally at 57, up through coaxial passage 41 in shaft 18, passage 43 in supporting plate 38, downwardly extending passage 45 in upper closure plate 33, into the rotary compressor cylinder 23, and is there compressed by the cooperation of blade 53 with eccentrically mounted ring 25 as the rotary compressor cylinder is turned in a clockwise direction and is discharged through passage 47, discharge valve 48 and passage 49 formed in compressor cylinder ring 22 and upper closure plate 33. It will also be seen that by virtue of the fact that blade-like portion 53 normally remains out of contact with eccentrically mounted ring 25 there exists no appreciable starting torque to be overcome by the electric motor, the compressor not coming into operation until the motor and rotating compressor cylinder 22 is turning at a predetermined speed; hence the capacity requirements of the electrical motor are materially reduced without sacrificing efficiency of operation. Special attention is also directed to the fact that the electric motor laminations 24 and the rotary compressor cylinder ring 22 are combined into one assembly in corresponding axial relation as differentiated from the normal arrangement of spacing the same along the axis of rotation which results in a much more compact construction making it possible to reduce the overall axial dimension of the entire unit with the accompanying advantage, among others, that identical pressed metal domes 11 and 12 may be employed and the overall dimension of the entire refrigerating unit including the cabinet is reduced.

It will be noted that by virtue of the rotation of the compressor body including closure ring 33 in which discharge passage 49 is formed, there is present a reaction effect of the compressed refrigerant being discharged, which reaction effect assists the electric motor elements in turning the compressor. This torque effect of the gases discharging from passage 49 is appreciable and makes possible a corresponding reduction in the capacity requirements of the electric motor elements. This phenomenon may be readily understood by analogy to the action of water discharging from the nozzle of a hose. There is of course no such advantageous action in the case of stationary housing compressors because there is not present the necessary relative movement between the discharge orifice and the space into which the compressed refrigerant is being discharged.

The check valve assembly 57 may include a tubular member 67, one portion of which is received within connector 68, the other portion of which extends into a check valve body 70 into which it may be hydrogen brazed or silver soldered, there being a light press fit between the tubular member 67 and the connector 68 to provide the necessary slip fit required by temperature changes or excessive pressures. A disc-type of valve 69 is received within the check valve

body 70 in engagement with the valve seat formed therein against which it is urged by means of a spring 71.

For the purpose of effecting the necessary lubrication of the critical parts a sleeve 72 is pressed about a depending rim 73 extending from lower closure plate 31 downwardly about shaft 18 to a point slightly below the normal oil level 74 within frame member 14. Since the pressure within the frame 14 above the liquid level 74 is always greater than that existing within the cylinder 23 on the lower pressure side of said cylinder, the oil will be forced up between sleeve 72 and shaft 18, between the bearing 32 and shaft 18, between the eccentric 26 and ring 25 and between the ends of the roller 25 and cylinder end plates 32 and 33 in the cylinder 23. Also the oil will be forced up between the shaft 18 and bearing 34 between the upper revolving seal bearing between bearing plate 38 and the upper end of the shaft 18 into the suction passage.

The other usual necessary elements required to produce an operative compressor assembly will, of course, be employed but need not be described here in further detail than to mention that the same include the connection 62 for delivering the compressed refrigerant to the conduit (not shown) leading to the condenser, the connection 68 for the conduit leading from the evaporator to the check valve assembly 57, as well as the electrical connection indicated generally at 64 leading to the motor windings.

While I have described my invention in connection with a specific embodiment thereof, it is to be understood that this is by way of example rather than by way of limitation and that the same is to be defined by the appended claims which should be given a scope commensurate with the prior art.

I claim:

1. In a motor compressor unit including means defining a sealed enclosing housing, a motor and compressor assembly supportably carried within said enclosing housing, said assembly comprising motor stator laminations and field windings, means forming a non-rotatable shaft extending upwardly in axial relation within said field laminations and windings, means defining a compressor body and motor rotor combination for rotation on said shaft in axial relation to each other within said field laminations and windings, said last named means comprising an annular rotatable ring formed therein with a cylindrical compressor chamber, means adjacent the axial extremities of said cylindrical compressor chamber defining bearings for rotatably mounting said compressor body and rotor on said shaft, compressor means eccentric to said shaft and journaled thereon between said bearings within said cylindrical compressor chamber, means defining a divider blade assembly carried within said annular rotatable ring, said last named means including a blade-like portion arcuately adjustable into and out of engagement with the outer periphery of said compressor means, spring means urging said blade-like portion in a direction away from engagement with said compressor means with a predetermined torque, a pocket in the portion of said divider blade opposite said blade-like portion for receiving material having higher specific gravity than the material of said divider blade, for effecting predetermined weight distribution of said divider blade assembly, centrifugally responsive means including said pocket and said higher specific gravity material effective

to move said blade-like portion into engagement with said compressor means upon rotation of said annular compressor ring at a predetermined speed, a plurality of motor rotor defining laminations embracingly received about the external periphery of said annular rotatable compressor ring and fixed thereto cooperating with said field windings for effecting rotation of said annular compressor ring, and means for delivering refrigerant to be compressed to said cylindrical chamber on one side of said divider blade-like portion and means on the other side of said divider blade-like portion for discharging the compressed refrigerant from said cylindrical chamber into said enclosing housing.

2. In a motor compressor unit, means defining a sealably enclosing housing, a motor and compressor assembly mounting frame supportably carried within said enclosing housing and comprising a surrounding wall portion having a pressed fit within said housing, motor stator laminations and field windings mounted within said wall portion for fixed support thereby, said frame means having a non-rotatable shaft extending therefrom upwardly in axial relation within said field laminations and windings, means defining a compressor body and motor combination for rotation on said shaft within said field laminations and windings, said means comprising an annular rotatable ring member formed therein with a cylindrical compressor chamber, means closing the opposite extremities of said compressor chamber and having bearings therein for rotatably mounting said annular ring member on said shaft, cylinder defining means eccentrically arranged on said shaft within said compressor chamber between the extremities thereof, means defining a divider blade assembly rotatably carried on the inner periphery of said rotatable compressor ring, said means including a blade-like portion arcuately adjustable into and out of engagement with the outer periphery of said eccentric cylinder defining means, spring means urging said blade-like portion in a direction away from engagement with said eccentric cylinder defining means with a predetermined torque, a pocket in the portion of said divider blade opposite said blade-like portion for receiving material having higher specific gravity than the material of said divider blade for effecting predetermined weight distribution of said divider blade assembly, centrifugally-responsive means including said higher specific gravity material effective to move said blade-like portion in opposition to the urge of said spring means into engagement with said eccentric cylinder upon the rotation of said cylindrical ring at a predetermined speed, a plurality of motor rotor defining laminations embracingly received about the external periphery of said rotatable compressor ring and fixed thereto for cooperation with said field windings for effecting rotation of said rotatable compressor ring, and means for delivering refrigerant to said cylindrical chamber on one side of said divider blade-like portion and means on the other side of said divider blade-like portion for discharging the compressed refrigerant from said cylindrical chamber into said enclosing housing.

3. In a motor compressor unit, including means defining a sealed enclosing housing, a motor and compressor assembly supportably carried within said enclosing housing, said compressor comprising an annular rotatable ring formed therein with a cylindrical compressing

chamber, means defining a cylindrical member eccentrically arranged within said compressing chamber, means defining a divider blade assembly including a blade-like portion, means supporting said blade-like assembly on said annular rotatable ring for arcuate movement of said blade-like portion into and out of engagement with the outer periphery of said eccentrically disposed member for dividing said chamber into a high pressure zone and a low pressure zone, spring means urging said blade-like portion in a direction away from engagement with the periphery of said eccentrically arranged cylindrical member with a predetermined torque, said blade assembly further including a pocket having therein a material of higher specific gravity than the material defining the divider blade assembly to provide centrifugally-responsive means effective to move said blade-like portion into engagement with said eccentrically arranged cylindrical member in opposition to the action of said spring upon the rotation of said annular ring at a predetermined speed, and means for delivering refrigerant to said compressor to be compressed and means for delivering compressed refrigerant therefrom.

4. In a motor compressor unit including means defining a sealed enclosing sheet metal housing, a motor and compressor assembly supportably carried within said enclosing housing said assembly comprising a bowl-like rigid frame the radial outer periphery of said frame being press fitted within said housing, a supporting shaft carried by said frame and extending in non-rotatable coaxial relation thereto, said compressor comprising an annular rotatable ring formed therein with a cylindrical compressor

chamber, means carried by said shaft defining a cylindrical member eccentrically arranged within said compressor chamber, means closing the terminal portions of said annular ring including bearings supporting said ring for rotation on said shaft, means defining a divider blade assembly carried by said annular rotatable ring, said divider blade assembly including a blade-like portion arcuately adjustable into and out of engagement with the outer periphery of said eccentrically disposed cylindrical member for dividing said compressor chamber into a high pressure zone and a low pressure zone, spring means urging said blade-like portion in a direction away from engagement with the periphery of said eccentrically arranged cylindrical member with a predetermined torque, said divider blade assembly including a pocket having therein a material of higher specific gravity than the material defining the divider blade assembly to provide centrifugally-responsive means effective to move said blade-like portion into engagement with said eccentrically arranged cylindrical member upon the rotation of said annular ring at a predetermined speed, said motor comprising a plurality of metal laminations embracingly received about periphery of said annular ring and fixed thereto, a second plurality of metal laminations surrounding said first-named laminations in radially spaced relation thereto and press fitted within said frame, motor windings associated with said laminations for producing the rotation of said annular ring, and means for introducing low pressure fluid to said low pressure zone and means for removing compressed fluid from said high pressure zone.

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