Dec. 20, 1938. F. L. TARLETON 2,141,053

MOTOR-COMPRESSOR UNIT FOR REFRIGERATING APPARATUS

Original Filed Oct. 31, 1934 2 Sheets-Sheet 1

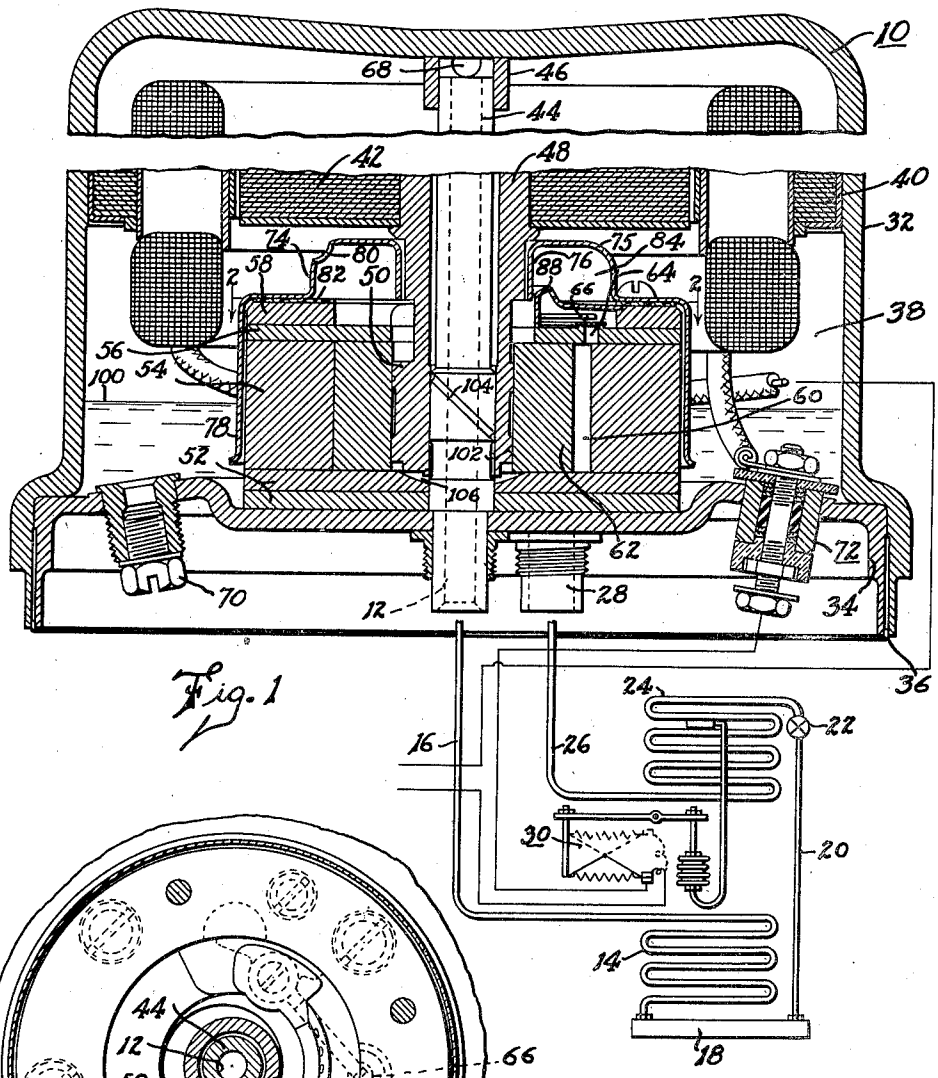



Fig. 1

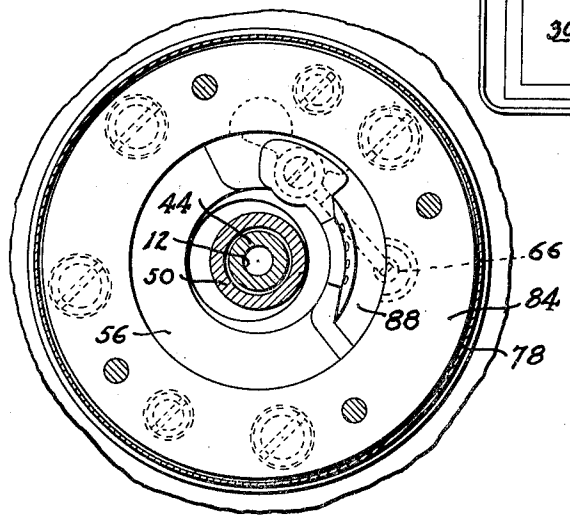



Fig. 2

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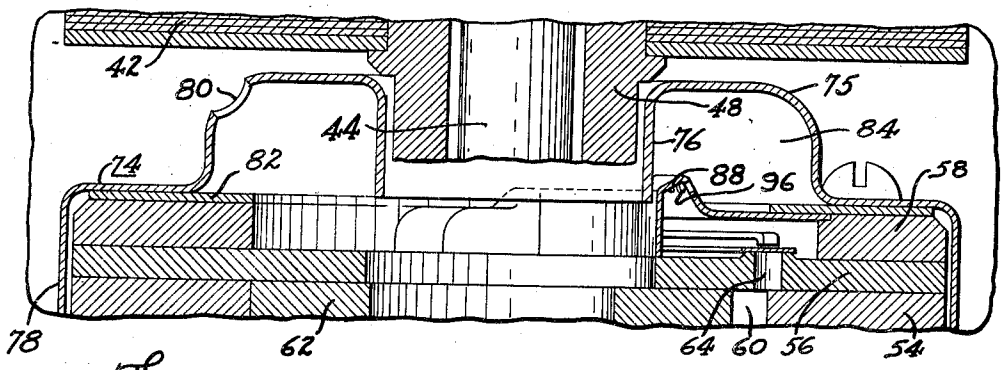



Fig. 3

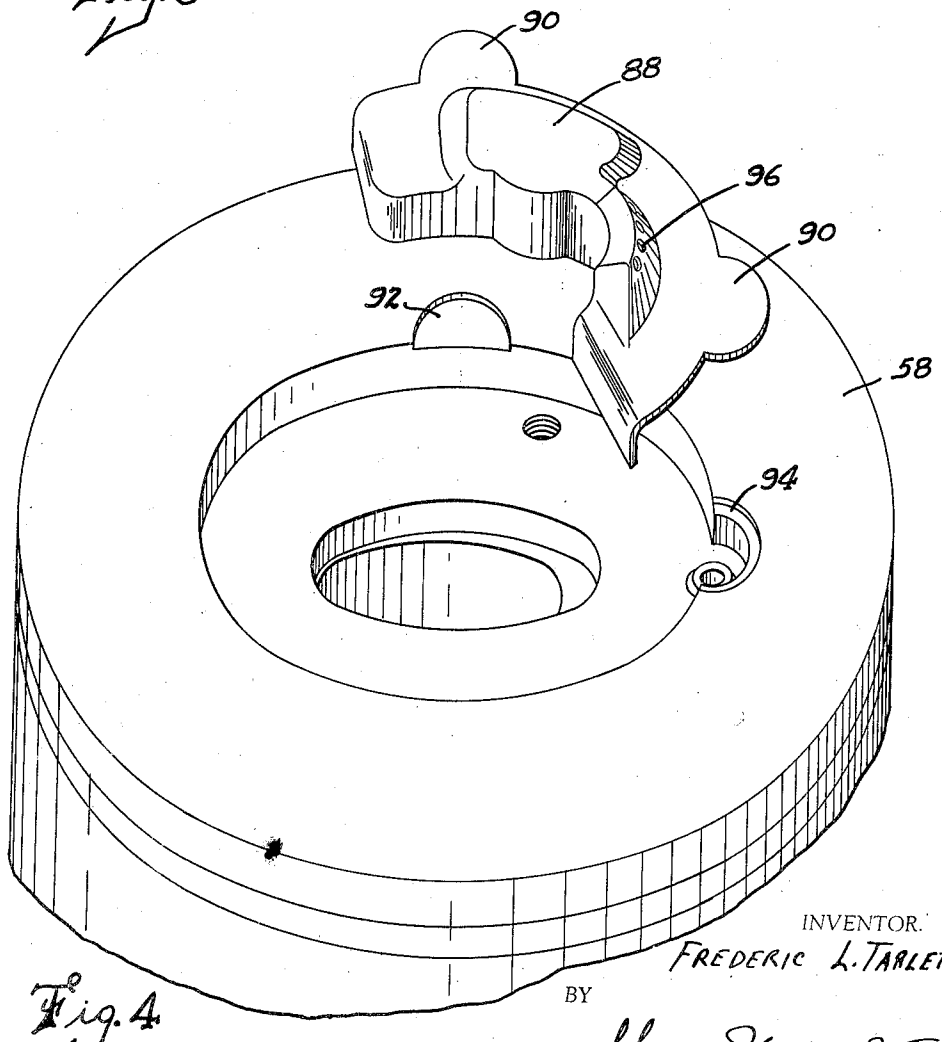



Fig. 4

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# UNITED STATES PATENT OFFICE

2,141,053

## MOTOR-COMPRESSOR UNIT FOR REFRIGERATING APPARATUS

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Renewed February 2, 1937

6 Claims. (Cl. 230—207)

This invention relates to refrigerating apparatus and more particularly to a novel motor-compressor unit of the hermetically sealed type for use in a refrigerating system.

It is common practice in the refrigerating art to provide a motor-compressor unit which is completely enclosed in a hermetically sealed casing within which refrigerant and lubricant for the compressor are circulated, one of the principal advantages of this class of construction being that the use of a stuffing box or other shaft seal is avoided. In motor-compressor units of this type, however, certain problems are incurred in connection with the maintenance of proper lubrication for the compressor which are peculiar to this type of unit since the hermetically sealed casing makes the compressor mechanism inaccessible for service and necessitates great care in insuring that all parts of the mechanism will operate properly for the life of the machine. In refrigerators intended for household use, present-day standards also require that noise of operation of the motor-compressor unit be reduced to a value which is substantially imperceptible and it has been found that particularly with units employing a rotary-compressor, the maintenance of an unfailing supply of substantially undiluted lubricant for feed to the compressor is a major factor in insuring quiet operation.

It is an object of the present invention, therefore, to provide a motor-compressor unit preferably of the hermetically sealed type in which provision is made for insuring the maintenance of an unfailing supply of lubricant for the moving parts of the compressor.

It is a further object to provide a novel separator in a unit of the present type for thoroughly separating the mixture of lubricant and refrigerant which is delivered from the outlet of the compressor.

Another object is to provide a compressor of this character which will be quiet in operation throughout its useful life.

It is also an object to provide a mechanism of the character described which is simple, reliable in operation and which is not only inexpensive in construction, but which also involves the addition of no wearing parts.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the invention is clearly shown.

In the drawings:

Fig. 1 is a vertical cross section of a portion of a motor-compressor unit embodying the present invention, and shows diagrammatically the elements of a complete refrigerating system;

Fig. 2 is a fragmentary cross section on line 2—2 of Fig. 1;

Fig. 3 is a view corresponding to Fig. 1 showing a portion of the mechanism on a larger scale; and

Fig. 4 is a view corresponding to Fig. 1 showing a portion of the mechanism on a larger scale.

Referring now to Fig. 1, there is shown a motor-compressor unit 10 having an outlet 12 from which compressed refrigerant is delivered to a condenser 14 by a conduit 16. The condenser 14 feeds liquefied refrigerant to a receiver 18, whence it is delivered by conduit 20 to an expansion valve 22 for expanding refrigerant into an expansion coil 24. A conduit 26 delivers expanded refrigerant to the inlet 28 of the compressor 10. A thermostatic switch 30 controls the motor-compressor unit 10 in accordance with the temperature of the expansion coil 24. The parts thus far described constitute the conventional elements of a refrigerating system and are well known in the art.

The motor-compressor unit 10 comprises a housing 32 having an open bottom which is closed by a base member 34 which in turn is welded to the housing 32 at 36, to provide a hermetically sealed chamber 38. Within the chamber 38 in the upper portion thereof, there is mounted an electric motor comprising a stator 40 and a rotor 42. A hollow stationary shaft 44 is located centrally of the housing 32 and mounted rigidly, as by welding, in the base 34. A socket member 46 secured to the top of the housing 32 positions the upper end of the shaft 44. A hollow compressor drive shaft 48 is journaled on the shaft 44 carrying at its upper portion the rotor 42, while at the lower end, there is provided an eccentric journal 50.

Secured to the base 34 is a compressor body member which may comprise a pair of bottom plates 52, a cylinder member 54, a valve cover plate 56 and a retainer plate 58. The parts 52 through 58 inclusive are rigidly secured together and to the base 34 and provide a cylindrical compression chamber 60 which is concentric to the axis of the shaft 44. The cylinder member 54 is provided with a radial slot, not shown, for receiving a divider block in the well known manner. Mounted within the compression chamber 60 is a cylindrical impeller 62 which is journaled on the eccentric journal 50 and is adapted to revolve in the compression chamber 60 without rotating. The customary divider block, not shown, is provided for dividing the chamber 60 into a com-

pression space and a suction space. The inlet connection 28 communicates with the suction space immediately adjacent one side of the divider block, while the discharge orifice 64 communicates with the compression space immediately adjacent the other side of the divider block as is well known in the art. The discharge orifice 64 is provided with a flapper valve 66 to prevent the return of high pressure gas from the chamber 38 to the chamber 60. Communication between the chamber 38 and the outlet connection 12 is provided through the hollow shaft 44 and through one or more apertures 68 provided in the socket 46. A removable plug member 70 is provided in the base for charging the unit with liquid refrigerant and lubricant. Connections to the motor are brought through the base 34 by the sealed lead-in connections 72.

In order to provide for a constant supply of lubricant to the running surfaces of the compressor, the following mechanism is provided. A cover or can member 74 is attached to the compressor body member and sealed thereto at the top by a gasket 82. The can 74 has a downwardly depending skirt 78 which embraces the compressor body member. At its top, the can member 74 is formed with an upwardly extending bulged portion 75 which terminates in a downwardly directed cylindrical sleeve 76 surrounding the shaft 48. The shaft 48 is made with a radius at this point at least as great as the greatest radius of the eccentric journal portion 50 in order to facilitate assembly. There is thus formed an annular chamber 84 of substantial volume on top of the compressor body for enclosing the flapper valve 66. One or more outlet ports 80 are provided in the wall of the chamber 84. For best results, it is preferred to make this outlet of a size which is several times larger than the outlet port 64 and than the clearance between shaft 48 and sleeve 76.

Secured to the valve plate 56 and the retainer plate 58 is a member 88 of peculiar shape and which may be best described as simulating a denture or set of false teeth. The member 88 is retained in position by a pair of lugs 90 which are adapted to be received in recesses 92 and 94 formed on the retainer plate 58, and are clamped therein by the gasket 82 and the can member 74. One or more orifices 96 are formed in the upper portion of the member 88 and preferably face outwardly and upwardly from the axis of the compressor. The member 88 thus acts as a shield to keep lubricant away from the valve 66. The members 74 and 88 may conveniently be formed of stamped sheet metal since their functions do not require greater accuracy of dimension than is readily obtainable from stamping operations.

After assembly of the unit, a charge of oil or other lubricant is placed in the chamber 38 through the plug 70 sufficient to maintain a level in the chamber 38 such as indicated by the line 100. Lubricant feed screws are provided for insuring lubrication of the bearings associated with the shaft 48 and may comprise a downwardly directed helical groove 102 on the eccentric journal 50 and an upwardly directed helical groove 104 on the lower journal of the shaft 44. A slot 106 is formed on the central portion of the uppermost plate 52 to provide a lubricant passage from the eccentric journal 50 to the inner lower shaft bearing.

In operation, whenever current is fed to the motor, by the closing of the switch 30, the shaft 48 is caused to rotate which in turn causes the impeller 62 to revolve within the compression space 60, drawing in gaseous refrigerant through the inlet connection 28 and discharging it through the exhaust orifice 64, all as is well known in compressors of the type described. The body of lubricant in the lower portion of the chamber 38 is drawn under the lower edge of the skirt 78 of the can 74 and up between cylinder 54 and skirt 78 by leakage between cylinder 54 and plate 56 from the suction side of the compression chamber and is fed to the compression chamber 60 at a very slow rate of seepage through the running joint at the divider block. This constitutes the only direct feed of lubricant to the compression chamber 60 from the main body of lubricant in the chamber 38.

Fluid discharged through the orifice 64 is, therefore, a mixture of compressed gaseous refrigerant and lubricant, the lubricant carrying a considerable amount of refrigerant in solution. This mixture of compressed gaseous refrigerant and entrained lubricant passes through the orifices 96 into the chamber 84. Due to the comparatively large size of the chamber 84, its velocity is decreased to a very low value which gives the entrained lubricant time to precipitate before leaving the chamber 84 through the orifices 80. The precipitated lubricant collects on top of the cover plate 56 to maintain a substantial body of lubricant over the top of the compressor and on top of the upper surface of the eccentric and the impeller. Since the lubricant is in direct contact with the compressor at this point, it is brought to a high temperature by the heat of compression and substantially all of the refrigerant dissolved therein is driven out by this heat.

Thus, it will be seen that a substantial body of practically undiluted oil is maintained above the valve plate 56 from which it flows downwardly onto the eccentric 50 and impeller 62. Thus, substantially undiluted oil is fed to the eccentric bearings and by the feed screw 102 is forced downwardly through the passage 106 to the lower shaft bearing. From this point, the feed screw 104 feeds lubricant upwardly to the upper shaft bearing, not shown. The substantially undiluted oil is also fed to the surfaces betwen the impeller 62 and the plates 56 and 52 respectively, providing lubrication and acting as a sealing fluid therefor. It has been found that considerable noise in compressors of the present type has heretofore been caused by lack of maintenance of a sufficient supply of lubricant for these surfaces, particularly at starting, which lets the lubricant film break down and permits a slight oscillating action of the impeller 62 about a horizontal axis.

The compressed gaseous refrigerant leaving the orifices 80 passes through the chamber 38 and up through the air gap of the motor and through ports in the stator or rotor (not shown) to enter the orifices 68 and pass through the hollow shaft 44. Since the orifices 68 are at the center of the unit, and since the rotor maintains the body of refrigerant revolving in the chamber 38, any entrained lubricant which is not already precipitated will be separated through centrifugal action and practically lubricant-free refrigerant will be delivered at the outlet 12.

Thus, the present invention provides for continued satisfactory operation of a hermetically sealed motor-compressor unit throughout substantially its useful life and insures quiet opera-

tion thereof by maintaining a supply of concentrated substantially undiluted lubricant for feeding to all the working surfaces of the compressor.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a motor-compressor unit the combination of a hermetically sealed housing, a motor in the upper portion of the housing, a rotary compressor in the lower portion of the housing, a central vertical drive shaft connecting the motor and compressor, an outlet for compressed fluid in the top of the compressor, a flapper valve controlling said outlet, means secured to the top of the compressor and surrounding said shaft defining a chamber enclosing said outlet and sufficiently large to reduce the velocity of fluid flow through said chamber enough to permit the lubricant entrained in the fluid to precipitate in the chamber, an outlet for compressed fluid at the top of said chamber which opens into said housing and is spaced from the compressor outlet and substantially larger than the compressor outlet and the area between the shaft and said means, a passage for conveying precipitated lubricant from said chamber to the compressor, and means in said chamber for shielding the flapper valve from the precipitated lubricant.

2. In a compressor, a sealed housing, a vertical cylinder in said housing, a vertical drive shaft in said housing, a rotary piston in said cylinder actuated by said drive shaft, an outlet for compressed fluid in the top of said cylinder, a flapper valve controlling said outlet, means secured to said cylinder and surrounding said shaft defining a chamber enclosing said outlet and sufficiently large to reduce the velocity of fluid flow through said chamber enough to permit the lubricant entrained in the fluid to precipitate in the chamber, an outlet for compressed fluid at the top of said chamber which opens into said housing and is spaced from the compressor outlet and substantially larger than the compressor outlet and the area between said shaft and said means, a passage for conveying precipitated lubricant from said chamber to the cylinder, and means in said chamber for shielding the flapper valve from precipitated lubricant.

3. In a compressor, a sealed housing, a vertical cylinder in said housing, a vertical drive shaft in said housing, a rotary piston in said cylinder actuated by said drive shaft, an outlet for compressed fluid in the top of said cylinder, a flapper valve controlling said outlet, means secured to said cylinder and surrounding said shaft defining a chamber enclosing said outlet and sufficiently large to reduce the velocity of fluid flow through said chamber enough to permit the lubricant entrained in the fluid to precipitate in the chamber, an outlet for compressed fluid at the top of said chamber which opens into said housing and is spaced from the compressor outlet and substantially larger than the compressor outlet and the area between said shaft and said means, a passage for conveying precipitated lubricant from said chamber to the cylinder, and means in said chamber for shielding the flapper valve from precipitated lubricant, said last named means including an inverted metallic cup over said valve with an opening at the top.

4. In a motor-compressor unit, the combination of a hermetically sealed housing containing a suppiy of lubricant, a rotary compressor in the housing having a discharge outlet at the upper side thereof and a divider block slidably mounted in the side wall thereof, a flapper valve at said discharge outlet, a rotary member projecting upwardly from said compressor, and a sheet metal cover member sealed to the upper side of said compressor, said cover member having a skirt which embraces the compressor and which terminates below the lubricant level whereby leakage around the divider block causes lubricant to be drawn up between the skirt and the compressor and into the compressor, the upper part of said cover member having another skirt portion above the compressor extending a substantial distance downwardly along said rotary member and closely surrounding the rotary member throughout said distance and defining with another portion of said cover member a lubricant precipitating chamber substantially enclosing said discharge outlet.

5. In combination with a compressor having a discharge outlet through which a mixture of compressed gas and lubricant is discharged, a rotary shaft projecting from one side thereof, a stamped sheet metal member embracing a portion of said compressor and forming a lubricant precipitating chamber over said discharge outlet, said metal member having an aperture provided with a cylindrical sleeve through which said shaft extends, said sleeve extending a substantial distance along said shaft and being slightly larger than said shaft so as to permit the escape of gas between said sleeve and said shaft, and a stamped sheet metal member in said chamber for shielding said discharge outlet, said last-named metal member comprising an inverted cup placed over said discharge outlet with provisions for the escape of fluid through which the discharge from said compressor outlet is caused to flow during operation of the compressor.

6. In a compressor, a sealed housing, a cylinder in said housing, a drive shaft in said housing, a piston in said cylinder actuated by said drive shaft, said cylinder having an outlet for compressed fluid, a valve controlling said outlet, a sheet metal stamping means secured to said cylinder and surrounding said shaft defining a chamber enclosing said outlet and sufficiently large to reduce the velocity of fluid flow through said chamber enough to permit the lubricant entrained in the fluid to precipitate in the chamber, said chamber having an outlet for compressed fluid which opens into said housing and is spaced from the compressor outlet and substantially larger than the compressor outlet and the area between said shaft and said means, a passage for conveying precipitated lubricant from said chamber to the cylinder, and means in said chamber for shielding the valve from precipitated lubricant.

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