Nov. 24, 1936. A. A. McCORMACK 2,062,035

MOTOR COMPRESSOR UNIT FOR REFRIGERATING APPARATUS

Filed May 30, 1930 2 Sheets-Sheet 1

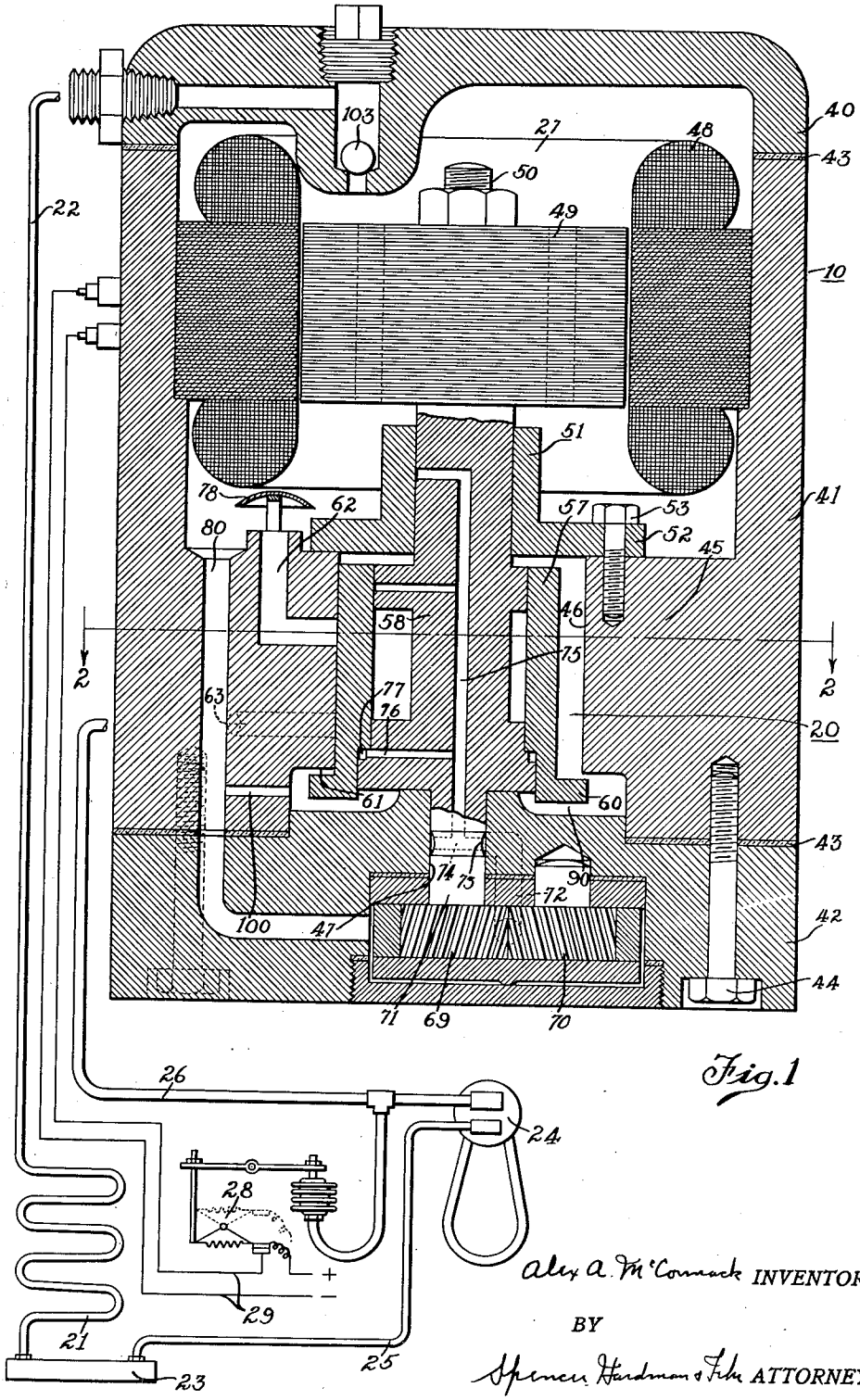


Fig. 1

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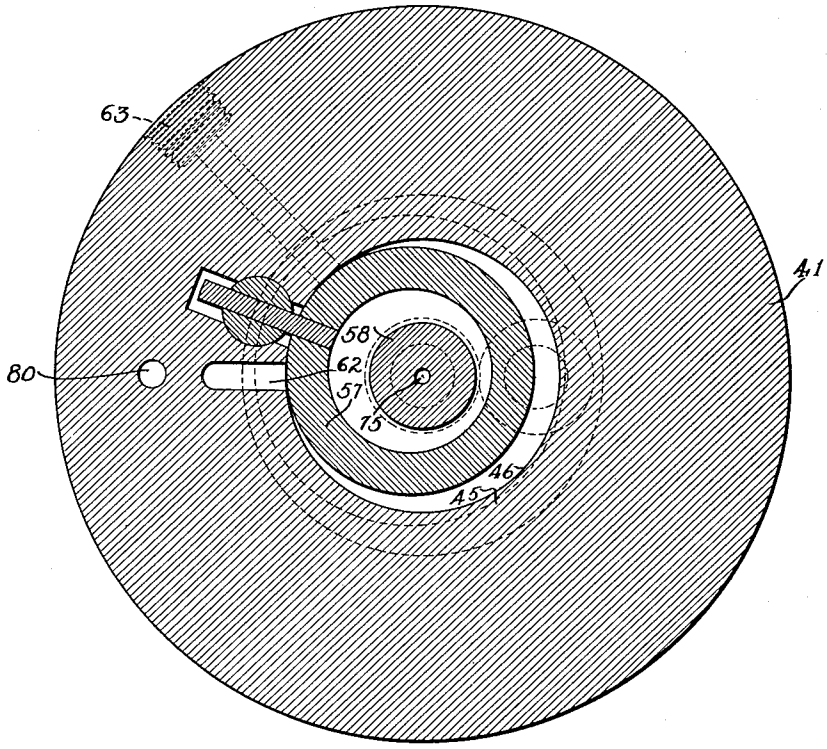


Fig. 2

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UNITED STATES PATENT OFFICE

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MOTOR-COMPRESSOR UNIT FOR REFRIGERATING APPARATUS

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Application May 30, 1930, Serial No. 457,565

10 Claims. (Cl. 230—29)

This invention relates to refrigerating apparatus of the compression type and more particularly to motor-compressor units for use with refrigerating apparatus of the compression type.

Refrigerating apparatus of the compression type generally includes, among other elements, a compressor having its discharge side connected to a condenser, and its intake side connected to an evaporator, the evaporator being in turn connected to the discharge side of the condenser through some sort of pressure reducing means. Refrigeration is produced by evaporating the liquid refrigerant under reduced pressure in the evaporator, the vapors being compressed into and condensed in a condenser under a considerable higher pressure and subsequently fed back to the evaporator. In order to maintain the evaporator or the refrigerator cabinet, which generally houses the evaporator, at a substantially constant temperature, it is customary to operate the compressor intermittently. That is to say it is customary to start the compressor when the temperature within the refrigerator reaches a predetermined high limit and to stop the compressor when the temperature reaches a predetermined low limit.

Since the discharge side of the compressor is under condenser pressure and the suction side is under evaporator pressure, it is obvious that the compressor, whether of the reciprocating type, the rotary type, the gyrator type or any other type, must start under load and consequently the motor must have a high starting torque, unless some means is provided for allowing the motor to reach a predetermined speed before the load is taken up.

It is to such a means that my invention particularly relates, having for one of its objects means for loading and unloading the compressor, whereby when the compressor has been brought up to speed by its driving means, it is automatically loaded and whereby when the speed of the compressor drops below a predetermined limit, it is automatically unloaded. More specifically, it is an object of my invention to utilize the lubricant within the system for operating the loading and unloading of the compressor.

A further object of my invention is to provide in compressors wherein compression is accomplished by a member having a rotary pumping effect, means whereby the compressing member may be moved by fluid pressure into operative pumping relation with the cylinder, when the member is driven at a predetermined speed by its driving member.

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 present invention is clearly shown.

In the drawings:

Fig. 1 is a view partly diagrammatic and partly in vertical cross-section of an apparatus embodying features of this invention; and

Fig. 2 is a cross-sectional view taken on the line 2—2 of Fig. 1.

In order to illustrate my invention, I have shown diagrammatically a refrigerating system having incorporated therein a motor-compressor unit of the hermetically sealed type. That is to say, a motor-compressor unit in which both the motor and the compressor are enclosed within a hermetically sealed casing, although it should be understood that my invention is not limited to such a compressing unit.

For example in Fig. 1 I have shown a hermetically sealed motor-compressor unit at **10** including a compressor **20** which is connected to a condenser **21** through a conduit **22**, a liquid refrigerant receiver **23** connected to the discharge side of the condenser **21**, and an evaporator **24**. The refrigerant may flow in a closed path through these parts in the order named. That is to say, the refrigerant is compressed in the compressor **20**, forced through the conduit **22** into the condenser **21** where it is liquefied, and finally collected in liquid form in the liquid receiver **23**. From the liquid receiver **23**, the liquid refrigerant passes through the conduit **25** into the evaporator **24**, which, it should be understood, is located within the cabinet or compartment to be cooled. The refrigerant, evaporating within the evaporator **24**, passes in vapor form through the conduit **26** to the suction side of the compressor **20**, which will be described in more detail hereinafter. The evaporator may be of any suitable type, and may be, for instance, of the float control valve type disclosed in the patent to Osborn, 1,556,708, patented October 13, 1925. The compressor **20** is shown as driven by an electric motor **27**, and the starting and stopping of the motor may be made responsive to the temperature conditions within the evaporator. To this end, a pressure responsive snap switch **28** is connected to the suction pipe **26** and this switch is located in the electric motor circuit **29** to thereby start and stop the motor in accordance with refrigerant pressure conditions within the evaporator **24**. The pressure conditions within the evaporator **24** vary in proportion to the temperature conditions

within the evaporator, and consequently the switch 28 is responsive to temperature conditions within the evaporator.

The motor-compressor unit indicated generally by the reference character 10 is shown as consisting of an upper member 40, an intermediate member 41, and a lower member 42, suitably held together with gaskets 43 therebetween, by means of bolts, one of which is shown at 44. The intermediate member 41 is provided with an inwardly extending portion 45 forming a cylinder 46 for the compressor which compressor is herein shown as of the gyrator type.

Mounted above the cylinder 46 is a motor 27, consisting of the stator 48 secured to the walls of the intermediate member 41, and a rotor 49 mounted on a shaft 50, which shaft 50 extends downwardly through the cylinder 46 into a bearing surface 47 formed in the lower member 42. Above the inwardly extending portion 45, is mounted a bearing surface 51 for the shaft 50 which bearing surface is flanged outwardly as at 52, the outwardly extending flange 52 resting on and being secured to the inwardly extending portion 45 by means of bolts, one of which is shown at 53. The flange member 52 forms the upper surface of the cylinder 46.

The compressor includes a cylinder member and a piston member, and these members are so constructed that they are in sealing arrangement when the motor reaches a predetermined speed but are not in sealing arrangement when the motor runs below this speed. This unloads the compressor during the starting period.

In this particular embodiment the compressor is of the gyrator type and is provided with a gyrator piston member 57 mounted on the eccentric 58 formed integral with the shaft 50 of the motor. The gyrator piston member 57 is provided with an outwardly extending flange 60, which flange is adapted to bear against the surface 61 of the intermediate member 45, when the gyrator is moved to its uppermost position by fluid pressure as hereinafter fully described. The compressor is provided with a discharge passage 62 discharging into the sealed casing 10, and with a suction or inlet passage extending through the inwardly extending portion 45 as shown at 63.

In order to provide means for preventing a high starting torque or, in other words to provide means whereby a motor, having a low starting torque may be used, I construct the gyrator piston member 57 in such a manner that it does not assume its sealed or operative pumping position within the cylinder 46 until the eccentric 58 is driven at a predetermined speed. For example, I construct the gyrator in such a manner that it will remain spaced from the surfaces 52 and 61, as shown in Fig. 1, until the speed of the motor reaches a predetermined high limit, at which time it will be moved upwardly within the cylinder 46 to effect compression. To this end, the gyrator 57 is mounted for longitudinal movement upon the eccentric 58, and means in the form of an oil pump, operating in unison with the eccentric 58, is provided at the lower end of the motor shaft 50 for forcing oil or lubricant under pressure against the lower end of the gyrator 57 to cause the same to move upwardly. For example as shown, an oil pump comprising the gears 69 and 70, the gear 69 of which is mounted on the extension 71 of the motor shaft 50, discharges oil or lubricant under pressure through a passageway 72 to the circumferential cavity 73, formed around the extension 71. From the cavity 73 the oil or lubricant flows through the radial passages 74 to the central passage 75 within the shaft 50, and thence into the lateral passage 76 to the offset chamber 77 below the gyrator 57.

The oil or lubricant for this purpose may be the oil or lubricant used in the compressor and, as shown, is taken from the oil separator 78 from where it flows downwardly through the passage 80 to the intake of the oil pump.

Thus it will be seen that, when the motor 27 and consequently the oil pump is operating at sufficient speed which may be predetermined, that the pressure exerted against the lower end of the gyrator 57 will cause the latter to be raised against the flange 52 and cause the outwardly extending flange 60 to bear against the surface 61, thereby bringing the gyrator or pump member into pump relation with the cylinder 46.

The gyrator is further held in position for its pumping operation by means of the pressure generated within the sealed casing after the gyrator becomes operative. For example, the high refrigerant pressure within the sealed casing may communicate through the passage 100 with the cavity 90 below the flange of the gyrator. Thus the pressure of the refrigerant itself tends to hold the gyrator in its upper position in addition to the lubricant pressure.

The operation of the device as a whole is as follows. Assuming that the compressor is idle, then, as soon as the temperature within the evaporator 24 increases to the predetermined high temperature limit, the snap switch 28 will start the motor 27. During the idle period the gyrator member 57 has assumed the position shown in Fig. 1 of the drawings, that is, its unloaded position. The starting of the motor will rotate the shaft 50, causing the eccentric to revolve within the gyrator member. The movement of the eccentric within the gyrator will cause the surface of the gyrator to move around the wall of the cylinder 46 producing in effect a rotary action. During the initial movement of the motor, the gyrator will not pump and consequently the motor starts under no load. As the motor speeds up, however, the oil pump 69, 70, speeds up until the pressure of the oil discharged by the oil pump is sufficient to lift the gyrator to its upper position. The gyrator then begins its pumping operation and refrigerant and oil are discharged under pressure through the passage to the oil separator 78. The refrigerant passes though the motor casing and through the check valve 103 into the condenser where it is liquefied, finally collecting in liquid form in the receiver 23. From the receiver 23 the liquid refrigerant passes to the evaporator 24 where it evaporates to produce a cooling effect.

Should the speed of the motor decrease or fall below a predetermined minimum, or should the oil become depleted, the gyrator 57 will resume its inoperative position and will be driven in an unloaded condition.

Thus I have disclosed apparatus for loading and unloading the compressor, which, as shown above is dependent for its operation upon the pressure of lubricant in the apparatus.

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. A compressing unit comprising a casing, a pumping member within said casing, a driving

means for said pumping member, fluid pressure means causing a relative movement of said pumping member with respect to said casing other than the normal compressing movement to thereby bring the pumping member into pumping relation with said casing when the speed of the driving means reaches a predetermined high limit, and means for causing a movement in an opposite direction to said relative movement when the speed of said driving means drops below a predetermined limit.

2. A compressing unit comprising a casing, a member having a rotary pumping effect mounted within said casing, driving means for said member, means for maintaining said member in an unloaded condition until the driving means attains a predetermined high speed, a second pump driven by said driving means and means for loading the said member at the predetermined high speed, said last named means including means dependent upon said second pump for moving said pumping member relative to said casing, to thereby bring said member in pumping relation with said casing.

3. A compressing unit comprising a casing, an eccentric mounted for rotary movement within said casing, driving means for said eccentric, a gyrator pumping member mounted on said eccentric, and means for moving said gyrator member with respect to said casing in one direction when the eccentric is driven above a predetermined speed by the driving means to load said gyrator pumping member, and means for moving said gyrator pumping member in the opposite direction to unload said gyrator pumping member when the eccentric is driven below a predetermined speed.

4. A compressing unit comprising a casing, a member having a rotary pumping effect mounted within said casing, driving means for said member, and means for unloading said member when the speed of said driving means is reduced below a predetermined limit, said last named means including means providing for relative movement of said member and said casing to move said member out of pumping relation with said casing, a second pump driven by said driving means, and means dependent upon said second pump for moving said member into pumping relation with said casing.

5. A compressing unit including a casing, an eccentric mounted for rotary movement in said casing, driving means for said eccentric, a gyrator pumping member mounted on said eccentric in said casing, means for unloading said pumping member when the speed of said eccentric falls below a predetermined limit, said last named means including fluid pressure means for causing relative movement of said pumping member with respect to said casing, to thereby move said member out of pumping relation with said casing, a second pump driven by said driving means, and means dependent upon said second pump for moving said member into pumping relation with said casing.

6. A compressing unit including a hermetically sealed casing, a motor mounted within said casing, a cylinder within said casing, an eccentric driven by said motor and mounted within said cylinder, a gyrator pumping member mounted on said eccentric, means for moving said pumping member into operative relation with said cylinder when the eccentric is driven at a predetermined high speed, said last named means including an oil pump, said pump discharging oil under pressure against the lower edge of said member.

7. A compressing unit comprising a casing, a pumping member within said casing, driving means for said pumping member and fluid pressure means for causing relative movement of said pumping member with respect to said casing, to thereby bring said pumping member into pumping relation with said casing when the speed of the driving means reaches a predetermined high limit, said last named means including an oil pump having its discharge exerting a pressure on said pumping member, and means dependent upon the pressure created by said pump for aiding said fluid pressure means in maintaining said pumping member in pumping relation.

8. A compressing unit comprising a casing, an eccentric mounted in said casing, a motor, a shaft for said motor operatively connected to said eccentric, a gyrator pumping member mounted on said eccentric within said casing, and means for moving said gyrator into operative relation with said casing, said last named means including an oil pump mounted on said shaft and means within said eccentric for delivering oil under pressure from said pump to said gyrator member.

9. A compressing unit comprising a casing, a member having a rotary pumping effect within said casing, means for loading said member when it is driven at a predetermined speed, said means including a body of lubricant within said casing, an oil pump communicating with said body of lubricant and means for permitting said pump to discharge lubricant under pressure to said pumping member to thereby move said member into operative relation to said casing.

10. A compressing unit comprising a casing, an eccentric mounted in said casing, a motor, a shaft for said motor operatively connected to said eccentric, a gyrator pumping member mounted on said eccentric within said casing, said pumping member and said eccentric cooperating to form an operating chamber therebetween, a second pump operatively connected to said motor for discharging fluid into said operating chamber for moving said gyrator pumping member into pumping relation when a predetermined speed of the motor is reached.

ALEX. A. McCORMACK.