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M. P. PENN

2,373,909

REFRIGERATING APPARATUS

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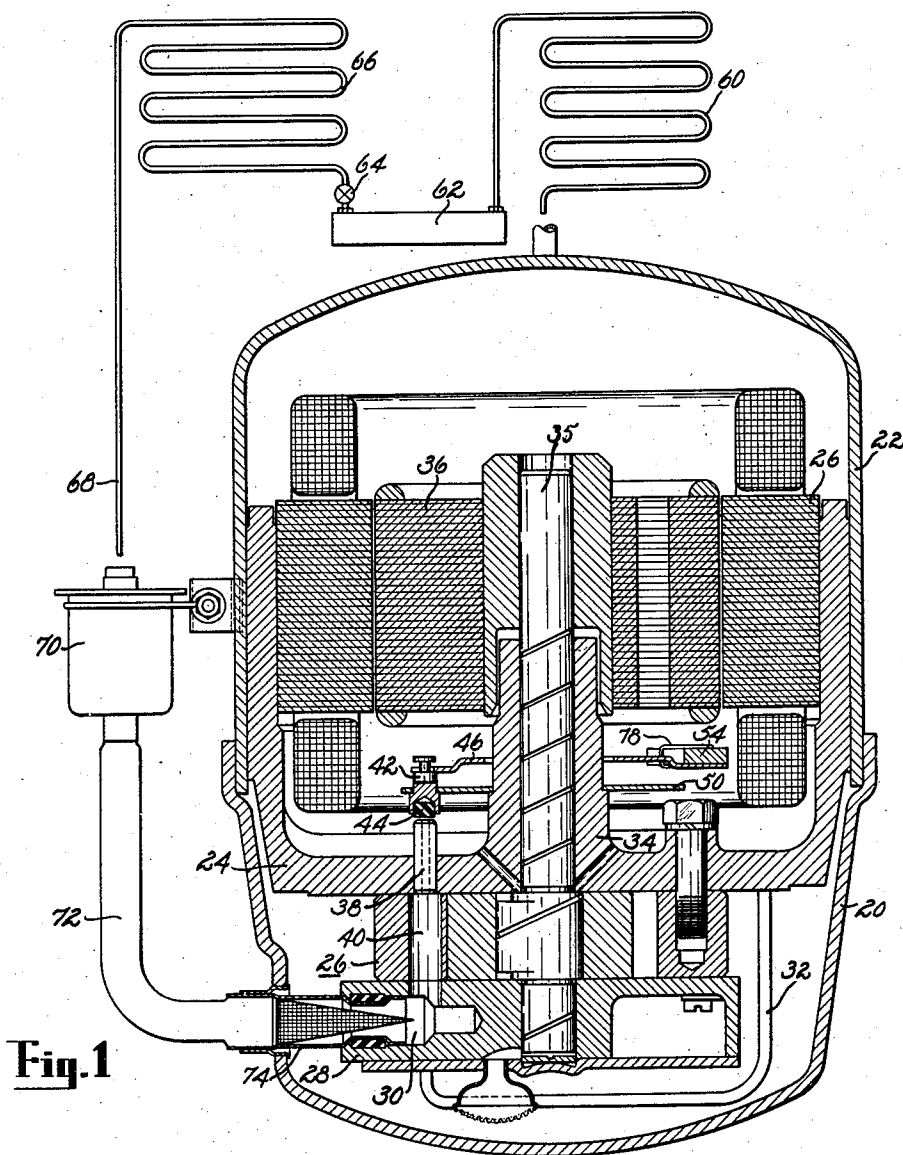


Fig. 1

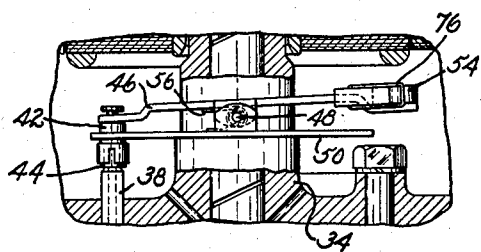


Fig. 2

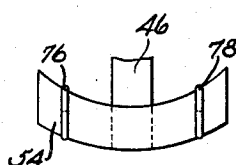


Fig. 3

INVENTOR.
Melvin P Penn
 BY *Spencer Hardman and Lehn*
 Attorneys

UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS

Melvin P. Penn, Dayton, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

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2 Claims. (Cl. 230—24)

This invention relates to electric motor-compressor units for refrigerating apparatus and other applications, and more particularly to unloading means therefor.

In the Lipmann Patent 1,899,341, an unloading valve is opened upon starting by the attraction of the increased field around the motor set-up by the high starting current which acts upon a magnetic actuating member. This arrangement, however, makes it necessary that the motor be energized before the unloading valve is opened. Even after the unloading valve is opened the compressor is not unloaded, since sufficient gas must pass through the opened unloading valve to equalize the pressures upon opposite sides thereof before the unloading is complete. Obviously these aspects are highly undesirable.

It is an object of my invention to provide an unloading valve arrangement which opens and equalizes the pressures to complete the unloading during the idle period and which is held closed during the normal operation of the compressor by the magnetic field set-up during the normal operation of the electric compressor motor.

It is another object of my invention to provide an unloading valve arrangement actuated by the electric compressor motor magnetic field which is free from chattering.

It is another object of my invention to provide a more simple, more reliable and less expensive unloading arrangement in which a magnetic member by its mass holds open the unloading valve when the electric motor is deenergized and which is energized by the stray magnetic field of the electric motor to close the unloading valve when the motor is energized.

To attain these objects I have provided an electric motor-compressor unit for example, such as the sealed unit type used in refrigerating systems wherein a pivoted member carrying a valve provided with a face of a rubber-like material is more than counterbalanced by a portion of magnetic material which is in close proximity to the electric motor and is attracted by the stray magnetic field thereof to overcome the effects of gravity and to attract the magnetic material to cause the lever to be pivoted to positively move the valve to closed position and retain it there during the energization of the electric motor.

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

In the drawing:

Fig. 1 is a vertical sectional view of a sealed motor-compressor unit embodying one form of my invention together with a diagrammatic representation of the remaining elements of a refrigerating system;

Fig. 2 is a fragmentary view showing the unloading valve held in the closed position; and

Fig. 3 is an elevational view of the armature of the unloading valve.

Referring now to the drawing and more particularly to Fig. 1, there is shown a sealed motor-compressor unit including a lower casting member 20 which telescopes over an upper casing member 22 which in turn fits on the motor-compressor frame 24. This motor-compressor frame 24 is cup-shaped and carries the stator 26 of the electric motor. Fastened to the lower face of this cup-shaped frame 24 is a rotary compressor 26 having a member 28 provided with an inlet passage 30 and also provided with an outlet passage connected to the pipe 32 which conducts the compressor outlet upwardly to the electric motor portion of the sealed unit.

The frame member 24 carries a bearing portion 34 which supports the drive shaft 35 carrying the rotor 36 of the electric motor and extending into the compressor 26. The frame member 24 carries a sleeve 38 connecting with a passage 40 leading to the inlet passage 30. The upper end of this sleeve 38 is machined and ground to provide a plane surface to serve as a valve seat. The passage through the sleeve 38 and the passage 40 constitutes an unloading passage since they connect the interior of the sealed unit, into which the compressor discharges, with the compressor inlet passage 30. Thus when the passage in the sleeve 38 is open the compressor is unloaded and merely operates to circulate gas through the compressor and the interior of the sealed unit without pumping against any material pressure differential.

In order to load the compressor, I have provided a valve 42 having an insert 44 of a suitable rubber-like material which will withstand aging as well as the effects of the gas and the lubricant within the sealed casing. There are several different classes of such material, such as one known as "Neoprene" or "Chloroprene" rubber. The valve 42 is connected to a lever 46 which is provided with a forked end engaging a groove provided upon the valve 42. This lever 46 is pivoted upon a pin 48 as shown in Fig. 2, to a stationary member 50 which fits upon the bearing portion 34 of the motor-compressor frame 24 and rests against the shoulder clearly shown on the

drawing. This member 50 also has an aperture which forms a guide holding the valve 42 in approximate alignment with the sleeve 38 and limits the upward movement of the valve 42, which is provided with a shoulder, clearly shown for this purpose.

The lever 46 at the end opposite the valve 42 is provided with an armature member 54 of magnetic material preferably soft iron. This member is preferably sufficiently heavy to more than counterbalance the weight of the valve 42 so that when the electric motor is deenergized this weight is sufficient to hold the valve 42 in open position so as to permit complete unloading of the compressor whenever the electric motor is deenergized. If it is not desired to rely upon gravity, a fine wire spring 56 may be coiled about the pivot pin 40 and have one end anchored against the member 50 with the other end pressing against the lever 46 to hold the valve open by the spring tension. In either case, however, the member of magnetic material is necessary.

This member of magnetic material is preferably located substantially in the position shown so that it is sufficiently near the rotor and stator to be most strongly attracted by the stray magnetic field necessarily occurring in that particular area due to the conventional design of the electric motor. The strength of this stray magnetic field increases with the load and the current consumed. By using this stray magnetic field one of the principal objections to magnetic unloaders is overcome, since no additional current is required for the operation of the unloader. Also due to this particular type of magnetic action and the rubber-like valve face the usual difficulties due to alternating current chattering may be avoided. This is probably due to a considerable extent upon the location of the magnetic member 54 as near as possible to the air gap between the rotor 36 and the stator 26. However, when chattering does occur with a plain armature member 54, the armature member may be shaded with the copper bands 76 and 78 which prevent chattering by setting up induced currents in the armature. Instead of copper bands, bands of other good electrical conductors such as aluminum or silver may be used.

For the purpose of illustrating the application of the motor-compressor unit to a refrigerating system the sealed unit is shown connected to a condenser 60 where compressed refrigerant may be condensed and collected in a receiver 62 from

which the liquid refrigerant may be forwarded under the control of a suitable liquid flow control device 64 to a refrigerant evaporating means 66. In the evaporating means 66 the refrigerant 5 evaporated under reduced pressure which is maintained by the operation of the sealed unit which withdraws evaporated refrigerant from the evaporating means 66 through the suction conduit 68 which may be provided with a filter or moisture 10 absorber 70 and connected by means of the tubing 72 and a resilient metal connection 74 with the compressor inlet passage 30.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred 15 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. An electric motor-compressor unit comprising an electric motor and a compressor driven by the electric motor, said unit being provided with an unloading passage connecting the compressor inlet and outlet, a pivoted member, a valve normally open during idle periods and connected to said pivoted member for closing said unloading 25 passage, said member being provided with an armature of magnetic material of sufficient weight and leverage to cause the lever to be tilted to a position to open the valve when the motor is deenergized and so located adjacent the motor as to be in the magnetic field of the motor when energized to operate the lever to close the valve upon energization of the motor and to hold the valve closed throughout the continued energiza- 30 tion of the motor.

2. An electric motor-compressor unit comprising a compressor provided with an unloading passage connecting the compressor inlet and outlet, an electric motor having a rotor and a stator for driving said compressor, a valve for closing said unloading passage, means including an armature for substantially balancing said valve and for 40 lightly biasing said valve to open position and for holding the valve open throughout each idle period of the motor, said armature being located immediately adjacent the air gap between the rotor and the stator so as to be attracted directly and solely by the normal magnetic field of the motor throughout its entire period of energization 45 for closing and holding the valve closed throughout each operating period of the motor.

MELVIN P. PENN.