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REFRIGERATING APPARATUS

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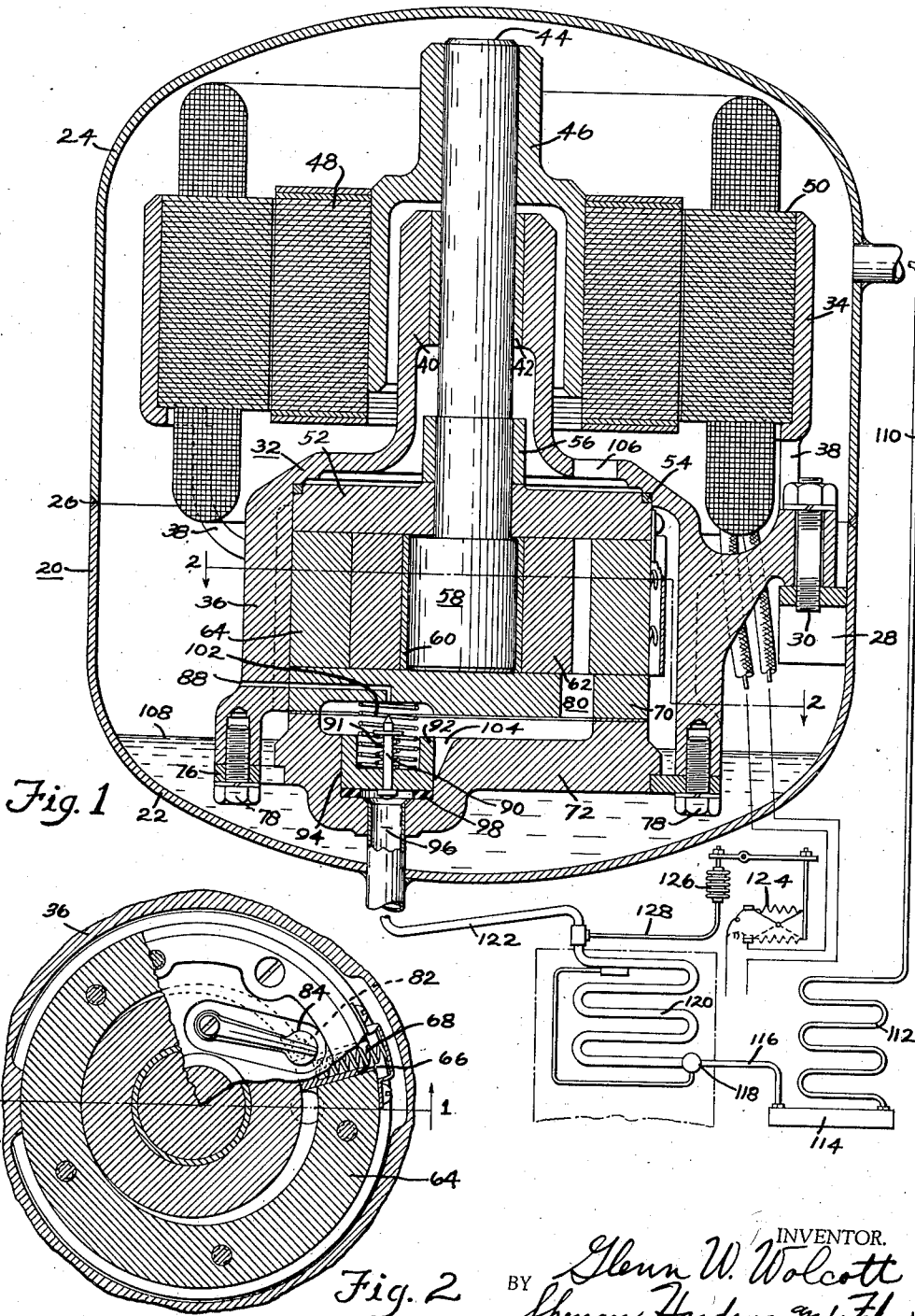


Fig. 1

Fig. 2

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REFRIGERATING APPARATUS

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2 Claims. (Cl. 230—24)

This invention relates to refrigerating apparatus and more particularly to means for controlling the loading and unloading of compressors.

In order to employ a relatively small, efficient motor it is desirable to provide a compressor with an unloader. Many of such unloaders have been in the past rather complicated.

It is an object of my invention to provide an extremely simple loading and unloading means for a compressor which will be operated by the pressure upon the suction side of the compressor.

It is another object of my invention to provide a means for controlling the loading and unloading of the compressor which also acts as a check valve upon the suction side of the compressor.

It is still another object of my invention to provide a combined piston valve and check valve upon the suction side of a compressor for controlling the loading and unloading of a compressor.

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 sectional view of a motor-compressor unit taken along the line 1—1 of Fig. 2, together with a diagrammatic representation of the remaining elements of a refrigerating system; and

Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1.

Briefly, I have shown a refrigerating system including a sealed motor-compressor unit having an electric motor directly connected to a rotary compressor of the eccentric type. In this compressor, the inlet of the compressor is provided with a piston valve which covers the suction inlet. This piston valve is provided with a valve needle for closing an unloading passage when the piston valve is forced open by the pressure differential created by the operation of the compressor. The piston valve, when sufficient pressure differential exists, opens a port and permits the feeding of the gas to the compressor inlet.

Referring now to the drawing and more particularly to Fig. 1, there is shown a sealed motor-compressor unit 20 comprising a lower casing member 22 and an upper casing member 24 which are welded together at the joint 26. Within the lower casing member 22, three supporting lugs 28 are welded to its inner walls in a symmetrical evenly spaced arrangement. These lugs are provided with studs 30 which are provided for fas-

tening a casting 32 in place. This casting 32 forms the framework 34 for the stator of the motor and an outer housing 36 for the compressor proper. The framework 34 is connected to the housing 36 by web portions 38. Extending upwardly from the housing portion 36 is a bearing support 40 provided with a bearing bushing 42. This bearing bushing 42 receives the motor shaft 44, the upper end of which receives an inverted cup-shaped member 46 upon which the rotor 48 of the motor is fastened. The rotor 48 surrounds the bearing bushing 42 while the connecting member 46 between the rotor 48 and the shaft 44 is up above the bearing 42. The stator 50 is held by the framework portion 34 of the casting 32.

The compressor proper is located within the housing 36 and is provided with a top plate 52 which is fitted into a countersunk portion in the housing and sealed by a lead gasket 54. This top plate 52 is also provided with a bearing 56 for the shaft 44. Beneath the bearing 56 the shaft 44 is provided with an eccentric 58 which is surrounded by a leaded bronze bushing 60 which in turn is fitted tightly into a roller member 62. Surrounding the roller 62 is the inner compressor housing 64 provided with a slot which receives the divider block 66 shown in Fig. 2. This divider block is recessed to receive a spring 68 which holds it in engagement with the roller 62.

When the motor operates, the eccentric causes the roller to be revolved with its periphery almost in contact with the inner wall of the inner housing 64.

The shaft 44 with its eccentric portion 58 rests upon an inner bottom plate 70 which also supports the roller 62. An outer bottom plate 72 holds the inner bottom plate 70 tightly against the bottom face of the inner housing 64. A spider-like ring member 76 holds the outer bottom plate in place and in turn is fastened to the outer compressor housing 36 by cap screws 78. Both the inner bottom plate 70 and the outer bottom plate 72 are provided with the inlet passage 80. This inlet passage passes through the inner bottom plate directly to one side of the divider block 66. The top plate 52 is provided with a discharge port 82 and a discharge valve 84 directly on the opposite side of the divider block from that of the inlet port 80.

In order to reduce the load upon a compressor during the starting period so that a smaller highly efficient motor with a low starting torque may be used, I provide a small unloading passage 88 which extends through the outer compressor

housing 36 and the inner bottom plate 70 to the inlet passage 80. Directly beneath the opening of this passage 88 into the passage 80 is a needle valve 90 which is operated by and normally moves with a piston 92 which fits into a recess 94 formed on the outer bottom plate 72. The needle valve 90 has a head which is yieldingly held against the bottom of the piston by a small spring 91. This piston, when the compressor is idle, covers the inlet opening 96 in the outer bottom plate 72. A gasket 98, preferably formed of a rubber-like product, containing a polymer of chloro-2-butadiene-1,3 is provided in the bottom of the recess 94 for the piston 92 to rest upon. This provides a seal for the piston.

The piston 92, when the compressor is not in operation is held in sealing engagement with the gasket 98 by a light compression type coil spring 102 so that it prevents any gas from entering the inlet 96. Thus, during any idle period the gas in the sealed unit housing 20 can enter the unloading passage 88 and flow into the compressor inlet passage 80. In this way, when the compressor starts it is provided with high pressure gas at the same pressure at which it discharges a gas so that the compressor starts in an unloaded condition.

The unloading passage 88, however, is extremely small in comparison with the capacity of the compressor, and the compressor soon creates a much lower pressure within the inlet passage 80. In a short time it reduces the pressure in the inlet passage below the pressure existing below the piston 92 in the opening 96 so that this pressure in the opening 96 forces the piston 92 upwardly so that the needle valve 90 closes the unloading passage 88. At the same time the piston 92 uncovers a port 104 provided in the walls of the recess 94 so that the gas may pass from the opening 66 into the inlet passage 80 of the compressor. The piston 94 is rather large in area and only a slight restriction is required in the port 104 to keep the piston 92 in its uppermost position closing the unloading passage 88. The needle valve spring 91 will keep the needle valve 90 tightly against its seat during the normal running period even though the piston may fluctuate or vibrate slightly.

After the unloading passage 88 is closed, the compressor draws gas through the opening 86 and the inlet passage 80 in the normal manner. The gas is discharged through the discharge opening 82, the discharge valve 84, and thence through an opening 106 from the outer compressor housing 36 into the interior of the sealed unit 20. The sealed unit 20 is provided with lubricant 108 which seals the bottom of the outer compressor housing 36. There is a slight leakage of gas from the chamber between the inner housing 64 and the outer housing 36 past the divider block into the compression chamber of the compressor. This draws lubricant into the compressor and provides lubrication for the compressor parts and the bearings.

The gas which is discharged from the compressor into the interior of the sealed unit 20 is conducted by conduit means 110 to a condenser 112 where the compressed refrigerant is liquefied and collected in a receiver 114. From the receiver the liquid refrigerant is forwarded through a supply conduit 116 to a thermostatic automatic expansion valve 118 which controls the flow of refrigerant into the evaporating means 120. The refrigerant evaporates within the evaporating means 120 under reduced pressure and is re-

turned to the compressor through a suction conduit 122 which connects with the inlet opening 96 of the compressor. The electric motor which drives the compressor is controlled by a low pressure switch means 124 which is provided with an operating bellows 126 connected by tubing 128 to the suction conduit 122.

I find that this type of system is particularly useful where it is desired to prevent high pressure gas from entering the evaporating means during the off cycle and where an unloading means is employed. It is particularly useful when used in a refrigerating system of rather small capacity which operates at a high back pressure. For example, this system is particularly useful when used for cooling drinking water, particularly when sulphur dioxide or methyl chloride are used as refrigerants in the system.

In this system as soon as the compressor stops the piston valve 96 moves to a closed position under the influence of the spring 102. This prevents any gas from passing back to the return conduit into the evaporating means during the off cycle. The piston valve 92 remains in this position until the compressor starts. During this off cycle high pressure gas passes through the unloading passage 88 into an inlet passage 80 so that the compressor may start with equal pressures upon its inlet and outlet sides.

When the compressor starts, it gradually reduces the pressure within the inlet passage 80 until the pressure is less than the pressure within the inlet 96. Then the piston valve 92 is raised by the excess in pressure in the opening 96 and the needle valve 90 is moved upwardly to a position where it closes the passage 88. The raising of the piston valve 92 uncovers the port 104 and permits the gas to flow from the evaporator 120 to the inlet passage 80 of the compressor. The piston valve 92 is sufficiently large in area so that only a small throttling link effect at the port 104 is necessary to keep the piston valve 92 in its upper position. The unloading passage 88 is sufficiently small in comparison with the pumping capacity of the compressor that the gas pressure within the inlet passage 80 may be rapidly reduced at the start of each cycle, after which the piston closes the unloading passage and opens the port 104.

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 means having an inlet and an outlet, said compressing means being provided with a restricted unloading by-pass passage connecting the inlet and the outlet, a check valve for closing the inlet, a by-pass valve for closing said unloading passage, and a resilient operating connection between said check valve and said by-pass valve for operating said by-pass valve by the movement of the check valve.
2. A compressing means having an inlet and an outlet, a check valve for closing said inlet, said compressing means being provided with a restricted unloading by-pass passage extending from the portion of low side of said compressing means between said check valve and said inlet to said compressor outlet, and a by-pass valve operated by said check valve for closing said unloading passage.

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