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COMPRESSOR UNLOADING VALVE

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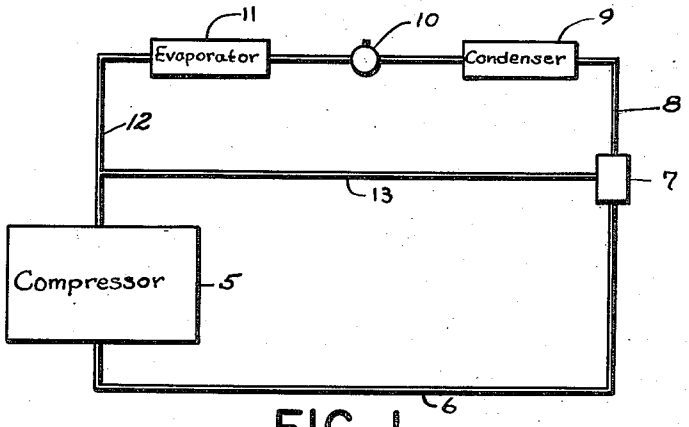

FIG. 1

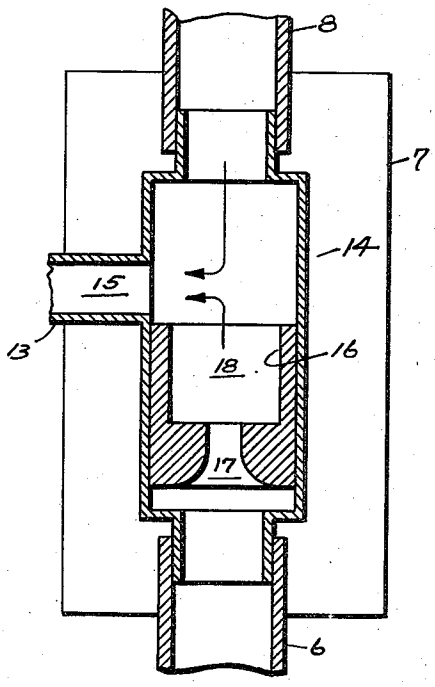

FIG. 2

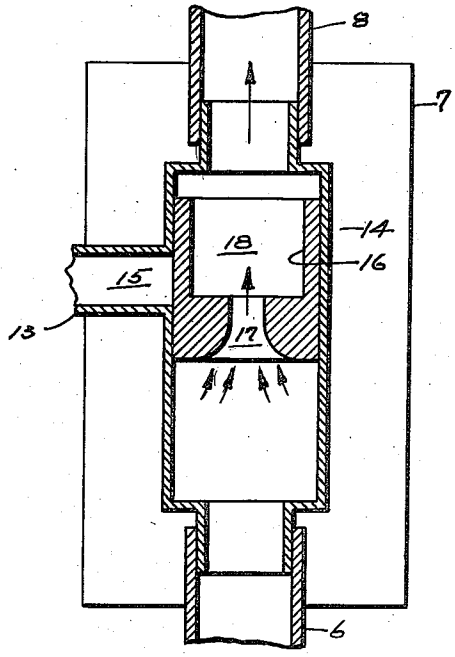

FIG. 3

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COMPRESSOR UNLOADING VALVE

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2 Claims. (Cl. 137—153)

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This invention relates to unloaders for fluid compressors, and relates more particularly to unloaders for refrigerant compressors.

Refrigerant compressors are driven for many duties by electric motors. If such motors are designed with high starting torques, their efficiences have to be sacrificed. Accordingly, it is the practice to use efficient motors having low starting torques and to provide some form of device for unloading the compressors when they are started up. The prior unloading devices have been complicated and expensive to manufacture, and have not been suitable for completely unloading the compressors immediately after their stoppage.

An object of this invention is to completely unload a compressor quickly after it is stopped.

Other objects of the invention are to simplify unloaders for compressors and to reduce their cost of manufacture.

The invention will now be described with reference to the drawing, of which:

Fig. 1 is a diagrammatic view illustrating a refrigeration system having an unloading valve embodying this invention;

Fig. 2 is a view, in cross section, of the valve, illustrating it in opened or unloading position; and

Fig. 3 is a sectional view similar to Fig. 2 but illustrating the valve in the closed or loading position.

Referring first to Fig. 1, the refrigerant compressor 5 has its discharge side connected by the pipe 6 to the inlet of the valve 7, the outlet of the valve being connected by the pipe 8 to the inlet of the condenser 9. The outlet of the condenser is connected through the expansion valve 10 to the evaporator 11, the evaporator being connected by the pipe 12 to the suction side of the compressor 5. The valve 7 has a by-pass outlet connected by the by-pass pipe 13 to the pipe 12, and through same to the suction side of the compressor.

As illustrated by Figs. 2 and 3, the valve 7 has a vertically extending passage 14 therein with its upper end connected to the pipe 8, and its lower end connected to the pipe 6. The valve has a by-pass passage 15 opening into the passage 14 and connected to the pipe 13. The gravity biased piston or plunger 16 is slidably fitted in the passage 14 and has a nozzle 17 in its lower portion, which converges in the direction of gas flow. The nozzle 17 discharges into the relatively large passage 18 in the upper portion of piston 16, the nozzle 17 and the passage 18 forming a gas passage extending through the valve and communicating at all times with the pipes 6 and 8.

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When the compressor is running, the high pressure gas against the underside of the valve 16 forces it upwardly in the passage 14 to the upper position illustrated by Fig. 3 where its outer wall extends across and closes the by-pass passage 15, all of the gas from the high pressure side of the compressor thus passing into the condenser. The gas, after it passes through the nozzle 17, expands into the passage 18, as illustrated by Figs. 2 and 3 of drawing. The nozzle has curved walls whereby it allows gas passage through with a small pressure loss, but with a high operating pressure differential. The arrows of Fig. 3 illustrate the gas flow through the nozzle, and the gas pressure effective against the underside of the valve and which lifts same after the start of the compressor.

When the compressor stops, the piston 16 falls by gravity to the lower position illustrated by Fig. 2 in which it uncovers the by-pass passage 15. The gas pressures in the system then are immediately equalized, the gas under pressure in the condenser flowing back into the valve 7 and through the by-pass passage 15 to the suction side of the compressor, and the gas under pressure from the discharge side of the compressor passing through the piston 16 and through the by-pass passage 15 to the suction side of the compressor. The gas flow, when the compressor stops, is illustrated by the arrows of Fig. 2.

The immediate pressure equalization provided by this invention when the compressor stops, is desirable for it often happens that a compressor will be started up again shortly after it has stopped and before normal pressure equalization can take place. The prior unloading devices have not had this advantage.

Another advantage of this invention is that it delays reduction of crank-case pressure when a compressor is started up, thus reducing oil foaming and consequent slugging.

While one embodiment of the invention is described for the purpose of illustration, it should be understood that the invention is not limited to the exact apparatus and the arrangement of apparatus illustrated since modifications thereof may be suggested by those skilled in the art, without departure, from the essence of the invention.

What is claimed is:

1. An unloading valve for a gas compressor comprising a valve body having inlet and outlet passages, and an intermediate passage between said passages, a by-pass passage opening into said intermediate passage, and a piston arranged in said intermediate passage so as to be moved by a rise in gas pressure through said inlet passage to

a position towards said outlet passage where it covers said by-pass passage, and so as to be moved to another position towards said inlet passage where it uncovers said by-pass passage upon a fall in the gas pressure through said inlet passage, said piston having a head facing the gas inlet passage and a skirt facing the gas outlet passage and having a relatively large passage between the head and the skirt with a nozzle which converges towards the relatively large passage extending through the head.

2. An unloading valve as claimed in claim 1 in which the inlet, outlet and relatively large passages extend in substantially vertical alignment, and in which the piston moves downwardly by gravity to uncover said by-pass passage upon a fall in the gas pressure.

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