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UNLOADERS FOR REFRIGERANT COMPRESSORS

Filed Dec. 19, 1956

Fig. 2.

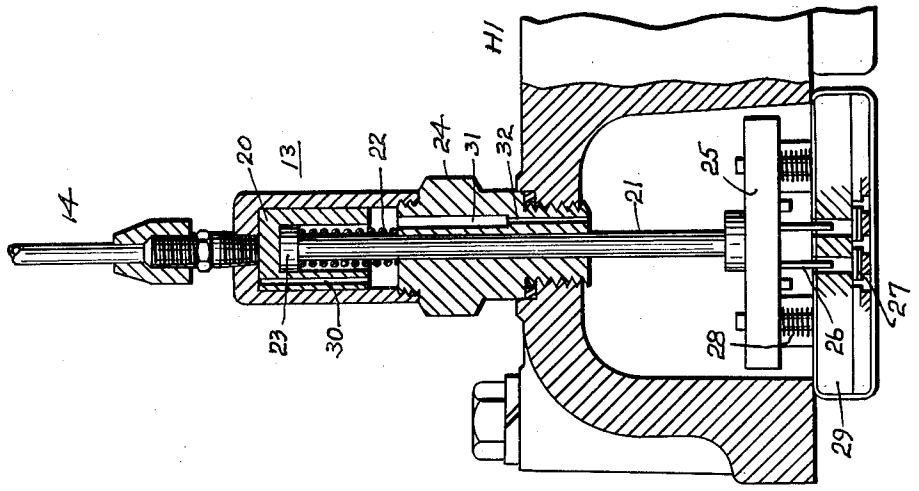
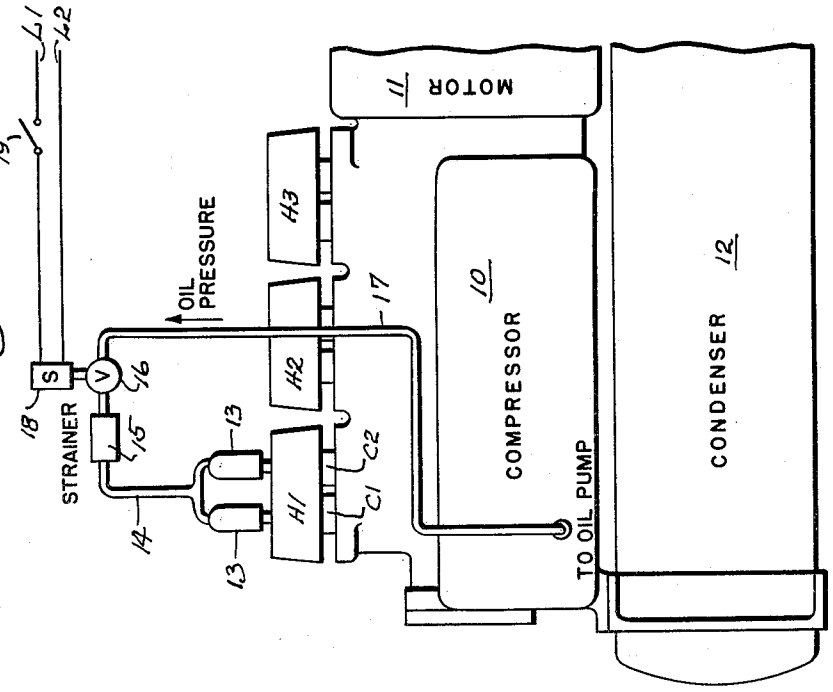


Fig. 1.



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UNLOADERS FOR REFRIGERANT COMPRESSORS

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This invention relates to refrigerant compressors, and has as objects to simplify and improve the mechanisms for unloading such compressors.

In many refrigerant compressors, unloading mechanisms are used for reducing the starting power, and for reducing the output as load reductions take place. The E. R. Wolfert Patent No. 2,296,304 discloses a successful form of unloader in which unloading is accomplished by depressing suction valve reeds so that they do not act as check valves as they ordinarily do during the compression strokes of the pistons in their associated cylinders. A toothed bar called a "comb" is used to hold a set of suction reeds down, the comb being forced down by refrigerant discharge gas pressure acting on a piston in an unloader cylinder located over this comb. The comb is returned from its depressed (unloading) position by relieving the pressure in the unloader cylinder and allowing return springs to lift the comb to its neutral position.

Lubricating oil is recirculated through a refrigeration system, and is used in some compressors for providing unloading pressure. It has the advantage that it is incompressible. Where such oil is used for providing unloading pressure, it has been customary to provide a relief tube connected through a solenoid operated valve to the suction side of the compressor for relieving the oil pressure within the unloader cylinder when the oil supply to it is discontinued when loading is desired.

This invention disposes with such a relief tube and solenoid operated valve by providing a small passage through the piston of an unloader cylinder. This passage provides a large pressure drop between the pressure within the unloader chamber and the suction side of the compressor. The dimensions of the passage are such that while no appreciable loss in pressure occurs during unloading operation, the passage will relieve the oil pressure in the unloader cylinder within a few seconds after the oil supply to the unloader cylinder is discontinued.

This invention will now be described with reference to the annexed drawings, of which:

FIG. 1 is a diagrammatic view of a refrigerant compressor embodying this invention, and

FIG. 2 is an enlarged cross-section of one of the unloader cylinders of FIG. 1.

A refrigerant compressor **10** driven by an electric motor **11** is adapted to discharge into a water cooled condenser **12**, the refrigerant from the condenser flowing through an expansion valve which is not shown, and an evaporator which is not shown, to the suction side of the compressor.

The compressor **10** has heads H1, H2 and H3. The head H1 which is typical has a pair of cylinders C1 and C2, equipped with unloader cylinders **13**. The unloader cylinders **13** are connected through a tube **14**, strainer **15**, valve **16** and tube **17** to the oil pump of the compressor.

A solenoid **18** when energized by its connection through a switch **19** to electric supply lines L1 and L2 opens the valve **16**. When the solenoid is deenergized by the switch **19** being opened, the valve **16** returns to its closed position.

Referring now to FIG. 2 of the drawings, each unloader cylinder **13** contains a piston **20** against the head

of which, oil admitted through the tube **14** and oil inlet fitting **9**, is applied. The piston has a central opening below its head into which extends the upper end of a rod **21**. A coiled spring **22** extends around the upper portion of the rod between a circular member **23** at the top of the rod, and the upper end of a fitting **24** at the lower end of the unloader cylinder. The fitting is threaded into the cylinder head H1. The lower end of the rod **21** is connected to the upper side of a comb **25** which has small rods **26** attached to its lower side, and which are adapted to depress suction reeds **27** of spring metal when the associated compressor cylinder is to be unloaded. Coiled springs **28** extend around some of the rods **26** between the lower side of the comb and the valve plate **29**. The reeds **27** are normally held in closed positions by their spring tension.

The piston **20** has a small passage **30** extending through its head and skirt. The fitting **24** has a small passage **31** extending from its upper side, the lower end of which connects with the upper end of a smaller passage **32**, the lower end of which extends through the bottom of the fitting. The passages **30**, **31** and **32** are circular in cross-section.

In operation, when unloading is desired, the switch **19** which may be manually operated, or which may be part of a load control, is closed, the solenoid **18** is energized and opens the valve **16**, admitting oil under pressure from the tube **17** into the unloader cylinders **13** against the heads of their pistons **20**. The oil pressure forces the pistons downwardly, causing the combs **25** to depress the suction reeds **26**, thereby unloading the associated compressor cylinders.

When the switch **19** is opened for loading the compressor cylinders, the valve **16** closes, cutting off the oil supply to the unloader cylinders. The oil pressure through the inlet fitting **9** against the heads of the unloader pistons is relieved by the flow of oil from above the pistons through the passages **30**, **31** and **32** into the spaces within the compressor cylinder heads around the combs. These spaces are under suction pressure, and the oil passes from them through the suction valve reeds to the suction side of the compressor. When the oil pressure against the unloader pistons is relieved, the springs **22** and **28** aided by the spring action of the suction reeds, lifts the combs, permitting the suction reeds to seat during following compression strokes of the associated compressor cylinder.

The sizes of the passages **30**, **31** and **32** are so chosen as to prevent any appreciable oil loss during unloading periods, and to relieve the oil pressure above the unloader piston within a few seconds after the oil supply to the unloader is shut off.

The unloader piston **20** provides a convenient location for the passage **30**. This passage could, of course, otherwise be located, as in a by-pass, in the wall of the unloader cylinder, around the piston.

I claim as my invention:

1. In an unloader for a cylinder of a refrigerant compressor having suction valve reeds of spring metal, said reeds normally being biased by their spring tension to closed positions, said cylinder having an unloader cylinder, said unloader cylinder having a piston therein, said unloader including means connecting said piston and reeds for moving said reeds to open positions when oil is admitted into said unloader cylinder against said piston, said unloader including oil supply means including an oil inlet in said unloader cylinder connected to said compressor for supplying oil from said compressor into said unloader cylinder for causing said piston to move said reeds to open positions for unloading said

compressor cylinder, said unloader including means connected to said supply means between said compressor and said oil inlet for shutting off the supply of oil to said unloader cylinder, the improvement which comprises the provision of means for relieving the oil pressure against said piston after said oil supply has been shut off, said last mentioned means comprising means including relatively small passage means connecting said oil inlet through said reeds with the inlet of said compressor.

2. The invention claimed in claim 1 in which the passage means includes a passage extending through said piston.

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