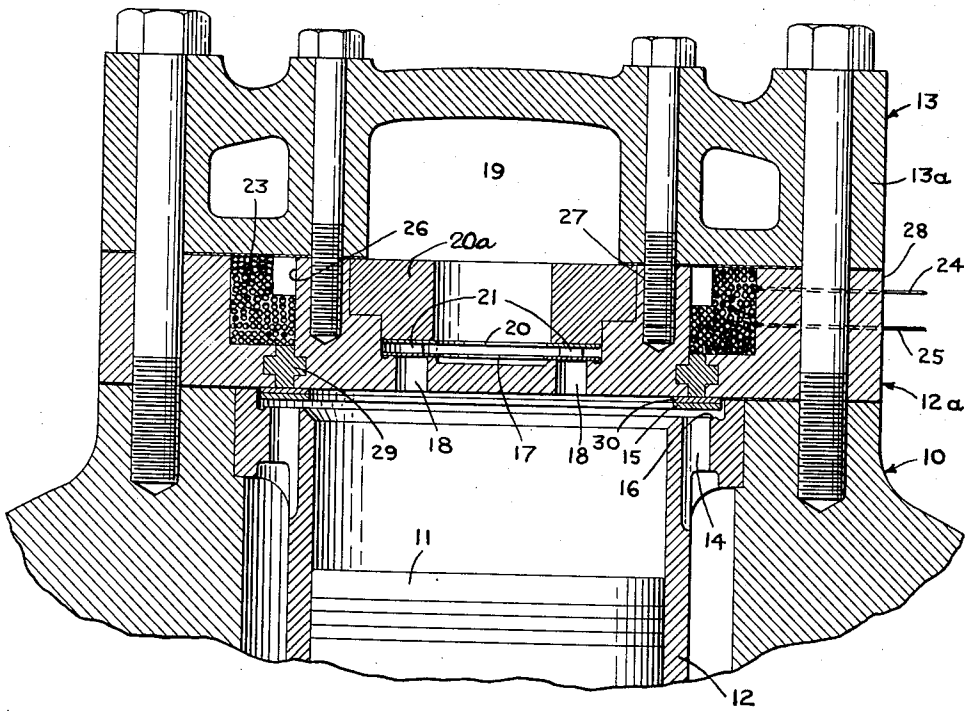
April 22, 1958 G. W. HARTWELL ET AL 2,831,625

UNLOADER FOR COMPRESSOR

Filed June 29, 1956




GEORGE W. HARTWELL
HERBERT E. LINDNER
INVENTORS

BY Daniel H. Bobis
atty

United States Patent Office 2,831,625 Patented Apr. 22, 1958



2,831,625

# UNLOADER FOR COMPRESSOR

George W. Hartwell and Herbert E. Lindner, South Hadley, Mass., assignors to Worthington Corporation, Harrison, N. J., a corporation of Delaware

Application June 29, 1956, Serial No. 594,994

2 Claims. (Cl. 230—24)

The present invention relates to a compressor and more particularly to a compressor provided with means for varying the capacity thereof.

In fluid compressors designed to operate at relative constant speed, the load on the system in which the compressor is arranged may sometimes vary, resulting in an inefficient operation of the compressor unless the capacity of the compressor can be varied with these system variations.

In accordance with the present invention, a compressor is provided having novel means for unloading the compressor to vary the output thereof which meets the changing requirements of the system in which it is arranged and thereby results in a considerable saving in operating power.

The present invention provides an unloading means for a compressor having electromagnetic means for unloading the compressor wherein the coil of the electromagnetic means is at no time exposed to the pumped gas, thus eliminating possible coil deterioration due to reaction with the gas, and eliminating the need for sealing of electrical leads into the electromagnet.

The present invention further provides an electromagnetic unloader for a compressor wherein a non-magnetic insert is used to guide the flux through the unloader valve to increase the magnetic force of the electromagnet and obtain the desired lifting and holding ability thereof.

The present invention further provides an electromagnet unloader for a compressor which is merely exposed to the pressure and temperature of conditions ambient to the compressor head resulting in an electromagnet having a coil which may be used over a long period of time.

The invention will be better understood from the following description when considered in connection with the accompanying drawing forming a part thereof and showing a fragmentary sectional view of a compressor embodying the unloader of the present invention.

Referring to the drawing, the reference numeral **10** designates a compressor having a reciprocating piston **11** disposed in a cylinder **12** with a cylinder head **13** comprising a lower plate member **12***a* and an upper cover member **13***a* bolted to the compressor frame to close off the upper end of the cylinder.

The enlarged upper end of cylinder **12** is provided with a plurality of vertical ports or passageways **14** drilled in the circumference thereof and spaced at intervals from one another to form inlets for refrigerant gas to be compressed in the cylinder. An annular ring **15** composed of a magnetic or conductive material such as steel forming a suction valve is disposed in a recess **16** in the cylinder above inlet ports **14** and is adapted to seat over the inlet ports to control the flow of gas therethrough.

An annular ring **17** forming a discharge valve is mounted on plate member **12***a* and is adapted to seat over a plurality of vertical outlet ports or passageways **18** disposed therein in communication with cylinder **12**.



Discharge ports **18** are arranged in a circle in the plate member and communicate with a discharge chamber **19** disposed in cover member **13***a* for discharging compressed refrigerant gas thereto. Ring **17** is normally maintained in a seated or closed position by an annular resilient ring **20** disposed thereabove having a plurality of depending fingers or ears **21** extending downwardly therefrom. A bored spacer member **20***a* is maintained between the plate and cover members for spacing ring **20** the desired position above ring **17**.

The unloader of the present invention comprises an annular coil **23** disposed in an annular recess **26** in plate member **12***a* between the inner and outer annular segments **27** and **28** thereof and having electrical conduits **24** and **25** extending transversely through segment **28** and connected to a source of winding or electrical power (not shown). It will be noted coil **23** is L-shaped in cross-section to establish distinct magnetic poles. An annular insert member **29** made of non-magnetic or non-conductive material is positioned in the cylinder head between segments **27** and **28** and between magnetic coil **23** and annular ring **15** forming the suction valve for the cylinder so that the incoming refrigerant gas to be compressed in the cylinder never contacts the magnetic coil, thus preventing deterioration thereof due to reaction with the gas. The provision of the non-conductive insert member **29** guides the flux from the coil when it is energized to the annular ring **15** by decreasing the width of the flux path and thereby concentrating it to intensify the effective force of the electromagnet in unseating the annular ring **15**. A return spring **30** in the form of a flat annular resilient ring is disposed in recess **16** above the annular ring **15** to maintain this annular ring seated over inlet passageways **14** when the coil **23** is not energized. Resilient ring **30** is normally arced in a vertical plane but when the magnetic coil **23** is energized, as shown in the accompanying drawing, to unload the compressor cylinder **12** it assumes a flat shape.

In operation, when the unloader of the present invention is not in use downward movement of the piston **11** in the cylinder will create a vacuum therein so that gas to be compressed entering inlet passageways **14** will lift the annular ring **15** off its seat overcoming the force in ring **30** tending to keep it seated and permit the gas to flow into the cylinder. Thereafter, when piston **11** moves upwardly in the cylinder, the gas therein is compressed and lifts discharge valve or ring **17** off its seat to open discharge outlet **18** so that the gas may be discharged into the cylinder discharge chamber **19**. Ring **30** will seat annular ring **15** to close inlet ports **14** at this time.

When it is desired to unload the compressor cylinder **12** the magnetic coil **23** is energized and a concentrated flux path is created in members **27** and **28** on either side of the non-magnetic insert member **29** disposed therein to lift the annular ring **15** from its seated position and maintain inlet passageways **14** open. This allows gas to pass into the cylinder on the intake stroke of piston **11** and to be discharged from the suction passageways **14** on the discharge stroke of the piston, thus making the compressor cylinder inoperative as far as the compressing of gas is concerned and thereby enabling the compressor to vary its output capacity.

It will be understood that the invention is not to be limited to the specific construction and arrangement of parts shown but they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In a compressor including at least one compression cylinder, a piston disposed for reciprocating movement in said cylinder, an annular valve in one end of said cylinder adapted to unload the compressor, and a cylinder head

disposed on said one end of said cylinder and adapted to house an electromagnet for operating said annular valve, said cylinder head comprising a plate member and a cover member, said plate member having an annular recess coaxial with said annular valve for housing the electromagnet and a central passageway spaced inwardly of said annular recess in communication with the cylinder for discharging fluids from the said cylinder, and said cover member having a central discharge chamber in communication with said central discharge passageway and an outer portion concentric to said discharge chamber adapted to fit over said plate member to thereby form a closure for the annular recess housing the electromagnet preventing contact between the said electromagnet and the fluids discharging from the cylinder.



2. The cylinder head housing the electromagnet as claimed in claim 1 wherein the electrical conduits of said electromagnet extend outwardly therefrom transversely through the plate member preventing contact between the said electrical conduits and the fluids discharging from the cylinder.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,713,234 | Litle | May 14, 1929 |
| 1,762,544 | Cadman | June 10, 1930 |
| 2,245,053 | Sanders | June 10, 1941 |
| 2,302,847 | Ferguson | Nov. 24, 1942 |
| 2,454,976 | Ploeger | Nov. 30, 1948 |
| 2,626,099 | Ashley | Jan. 20, 1953 |