

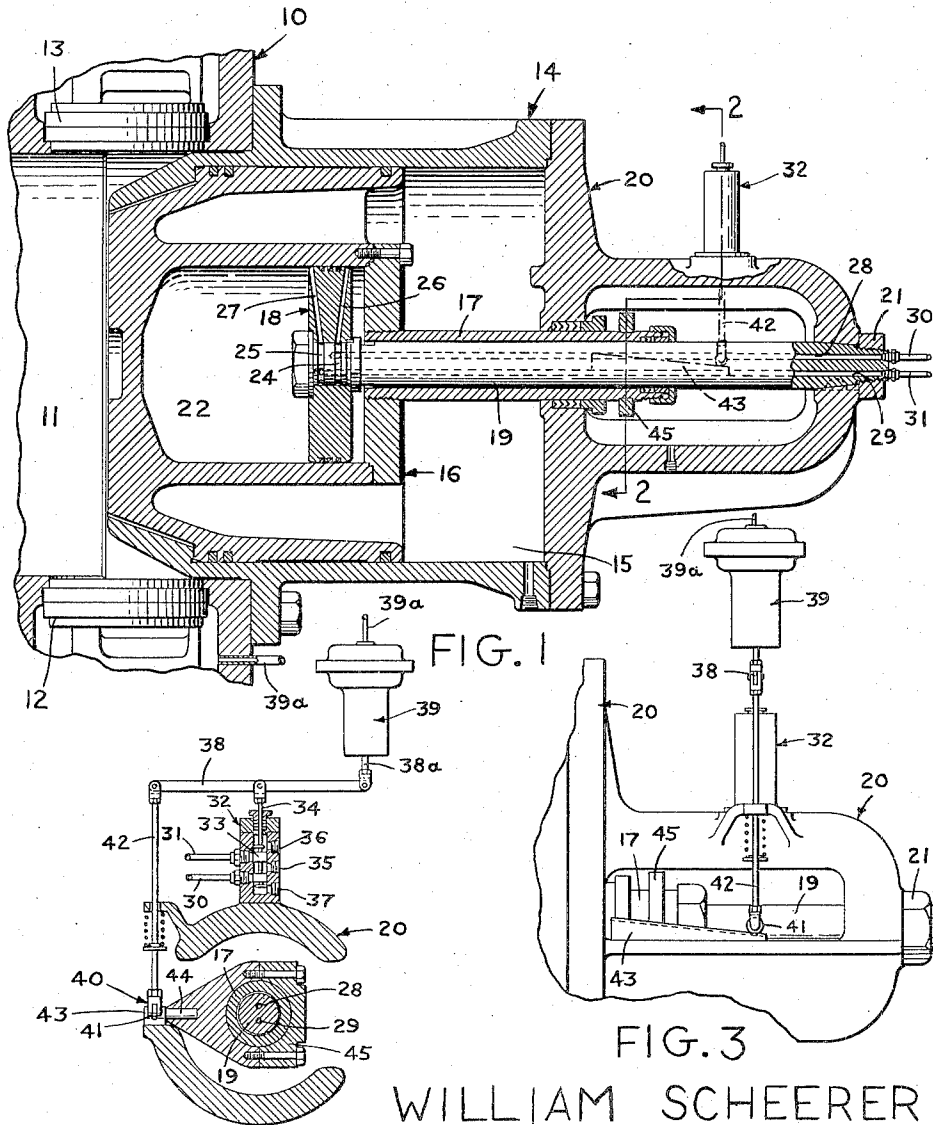
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VARIABLE CAPACITY COMPRESSOR

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## VARIABLE CAPACITY COMPRESSOR

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5 Claims. (Cl. 230—21)

The present invention relates to an air or gas compressor and more particularly to means for varying the volumetric output or capacity of the compressor.

In accordance with the present invention, a compressor is provided having a clearance chamber with piston means disposed therein, and actuating means operatively associated with the piston means to move the piston means in response to pressure control means to vary the volume of the clearance chamber and hence the capacity of the compressor.

The invention will be better understood from the following description when considered in connection with the accompanying drawing forming a part thereof and in which:

Figure 1 is a fragmentary view of the invention shown partly in section.

Figure 2 is a section taken on the line 2—2 of Figure 1, and

Figure 3 is a fragmentary view of the compensator mechanism embodied in the present invention.

Referring to the drawings, the reference numeral 10 designates a compressor provided with a cylinder 11 having inlet and outlet valves 12 and 13 respectively. A housing 14 is disposed adjacent cylinder 11 and has one end thereof adapted to fit into the cylinder. Housing 14 forms a clearance chamber or cylinder 15 for the compressor cylinder. A hollow piston 16 having a hollow piston rod 17 is disposed for reciprocating movement within cylinder 15. Piston 16 forms a cylinder 22 in which is disposed a stationary piston 18 having a piston rod 19.

Piston rod 17 is supported adjacent its outer end in a frame 20 secured to the outer end of housing 14. Piston rod 19 extends through piston rod 17 and is fixed to frame 20 by a nut 21 threaded against its tapered portion at the outer end thereof. Piston rod 17 has an inner diameter substantially larger than the outer diameter of rod 19 to permit rod 17 to slide or reciprocate on rod 19 as hereinafter described. The inner end of piston rod 19 is provided with circumferentially extending grooves or recesses 24 and 25 adjacent piston 18. Recess 24 communicates with a radially extending passageway 26 in piston 18 in communication with one end of cylinder 22 while recess 25 communicates with a radially extending passageway 27 in the piston in communication with the opposite end of cylinder 22. Passageways 28 and 29 extend axially of rod 19 and communicate with recesses 24 and 25 respectively, at one end thereof and with fluid inlet and outlet lines 30 and 31 respectively, at the other end thereof.

A pilot valve 32 is supported on frame 20 and is provided with a piston 33 therein having a piston rod 34 connected thereto. Fluid inlet and outlet lines 30 and 31 are connected to one side of the valve, while a fluid inlet 35 in communication with a source of fluid under pressure, not shown, is disposed on the opposite side of the valve between fluid outlets 36 and 37.

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The upper end of piston rod 34 is pivotally connected to the center of a lever 38. One end of lever 38 is pivotally connected to the actuating rod 38a of a pressure control means 39 which may be of any conventional construction such as a spring loaded diaphragm, for example. The pressure control means 39 communicates with any reference point in the system, for example the compressor discharge line by a control line 39a, and is operatively associated with lever 38 to move piston 33 in the pilot valve 32 in response to a change in pressure, to reciprocate piston 16 to vary the size of the clearance chamber 15 in communication with compressor cylinder 11 in order to vary the volumetric capacity of the compressor.

A compensator means 40 is provided to return piston 33 to its original position after being actuated by pressure control means 39. The compensator means 40 comprises a follower 41 connected to a rod 42 pivotally connected at the upper end thereof to the opposite end of lever 38 for actuating rod 38a. Follower 41 is adapted to ride on an inclined plane or cam 43 secured by pin 44 to yoke 45 mounted on rod 17 for reciprocating movement therewith.

In operation, when the pressure control means 39 responds to a change in pressure which moves actuating rod 38a downwardly, the rod moves the end of lever 38 attached thereto downwardly causing piston rod 34 and piston 33 to be moved downwardly in pilot valve 32 until fluid inlet 35 is in communication with fluid line 30 and fluid line 31 is in communication with fluid outlet 36. Fluid under pressure from a source, not shown, then flows through inlet 35 and line 30 through axially extending passageway 28, recess 24 and passageway 26 in the piston into the end of cylinder 22 opposite from compressor cylinder 11. Any fluid in the other end of cylinder 22 adjacent the compressor cylinder will be discharged therefrom through passageway 27, recess 25, passageway 29 and line 31 in communication with outlet 36. Since piston rod 19 is fixed to frame 20 and cannot move with respect to housing 14, the pressure of the fluid passing into cylinder 22 causes outer piston 16 to move in a direction away from compressor cylinder 11, with rod 17 sliding along rod 19. Thus, the size of clearance chamber 15 in communication with compressor cylinder 11 is increased and results in a smaller volume of air or gas being handled by the compressor. The compensator means 40 acts to return piston 33 to its original position with the movement of rod 17. As piston rod 17 and cam 43 move in the direction away from compressor cylinder 11, follower 41 rides upwardly along the cam moving follower rod 42 and the end of lever 38 connected thereto, upwardly. Lever 38 in turn moves piston 33 upwardly in pilot valve 32 to its original position therein and closes off communication of fluid line 30 with inlet 35 and fluid line 31 with outlet 36 to maintain the clearance chamber piston 16 in its new position in the clearance chamber.

When the pressure control means 39 responds to a change in pressure which moves actuating rod 38a upwardly, the rod moves the end of lever 38 attached thereto upwardly causing piston rod 34 and piston 33 to be moved upwardly in pilot valve 32 until fluid inlet 35 is in communication with fluid line 31 and fluid line 30 is in communication with fluid outlet 37 to discharge fluid from the other side of piston 18 in cylinder 22. Fluid under pressure passes into line 31 and through passageway 29, recess 25 and radial passageway 27 into the end of cylinder 22 adjacent the compressor cylinder causing piston 16 to move toward said cylinder, to decrease the size of clearance chamber 15. Simultaneously with this movement cam 43 moves toward cylinder 11 and follower 41 rides downwardly along the cam moving rod 42 down-

wardly and the end of the lever 38 connected thereto downwardly. This causes piston rod 34 and piston 33 to move back to its original position in pilot valve 32 to close off communication of fluid line 31 with inlet 35 and fluid line 30 with outlet 37. Thus, the present invention provides a simple and efficient means for varying the capacity of the compressor which means is moved by actuating means operatively associated therewith in response to pressure control means actuated by a change in pressure.

It will be understood that changes may be made in the form, location and materials used in the construction of and arrangement of the various parts of the apparatus disclosed herein without departing from the principles of the invention which is not to be limited excepting by the scope of the appended claims.

What is claimed is:

1. In a compressor, a compression chamber, a clearance chamber in communication with the compression chamber, piston means slidably disposed in said clearance chamber, and actuating means operatively associated with said piston means to move the piston means in the clearance chamber for varying the capacity of said compressor in accordance with operating requirements including, cylinder means in the piston means, a stationary member disposed to divide said cylinder into a plurality of pressure fluid chambers and having passage means disposed to flow pressure fluid into and from said fluid chambers to move the piston means, valve means for opening and closing said passage means to control the flow of pressure fluid to and from said fluid chambers, and control means operatively connected to said piston means to coact with said valve means for controlling the extent of movement of said piston.

2. In a compressor, a compression chamber, a clearance chamber in communication with the compression chamber, piston means slidably disposed in said clearance chamber, and actuating means operatively associated with said piston means to move the piston means in the clearance chamber for varying the capacity of said compressor in accordance with operating requirements including, cylinder means in the piston means, a stationary member disposed to divide said cylinder into a plurality of pressure fluid chambers and having passage means disposed to flow pressure fluid into and from said fluid chambers, said stationary member mounted on a rod-like element connected outwardly of said cylinder and said clearance pocket to hold said stationary element in position in said cylinder means, passage means in said rod-like element in communication with the passage means in said stationary member, a hollow piston rod slidably disposed about said rod-like element connected at one end to the piston element and having the other end extending outwardly of said clearance pocket, valve means actuated in response to operating conditions for opening and closing the passage means in said rod-like element to control the flow of pressure fluid to and from the pressure fluid chambers formed in the cylinder means, and control means operatively connected to said hollow piston rod and said valve means for controlling the extent of movement of said piston.

3. In a compressor as claimed in claim 2 wherein said

valve means includes, a valve housing having ports therein in communication with the passages in said rod-like element, a slide valve in the valve housing to control the opening and closing of said valve ports, and a cross-bar pivotally connected to said slide valve, said cross-bar disposed to receive signals for varying the position of said slide valve in accordance with operating conditions and connected to the control means for controlling the movement of said slide valve.

4. In a compressor as claimed in claim 2 wherein said control means includes, a wedge-shaped cam fixed to the hollow piston and movable therewith, a cam follower adapted to ride on said cam means, said cam follower coacting with said valve means for controlling the extent of movement of the piston.

5. In a compressor, a compression chamber, a clearance chamber in communication with the compression chamber, piston means slidably disposed in said clearance chamber, and actuating means operatively associated with said piston means to move the piston means in the clearance chamber for varying the capacity of said compressor in accordance with operating requirements including, cylinder means in the piston means, a stationary member disposed in said cylinder to divide the cylinder into a plurality of pressure fluid chambers and having passage means disposed to flow pressure fluid into and from said fluid chamber, said stationary member mounted on a rod-like element connected outwardly of said cylinder and said clearance pocket to hold said stationary member in position, passage means in said rod-like element in communication with the passage means in said stationary member, a hollow piston rod slidably disposed about said rod-like member connected at one end to the piston element and having the other end extending outwardly of said clearance pocket, a valve housing having ports therein in communication with the passages in said rod-like element, a slide valve in the valve housing to control the opening and closing of said ports, and a cross-bar pivotally connected to said slide valve, said cross-bar having one end disposed to receive signals for varying the position of said slide valve, cam means on the end remote from said signal receiving means, a wedge-shaped cam fixed to the hollow piston and movable therewith, said cam follower means adapted to ride on said cam follower and to feed back signals to said cross-bar for nullifying the actuating signals for moving the slide valve whereby the extent of movement of said piston in the clearance chamber will be controlled.

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