

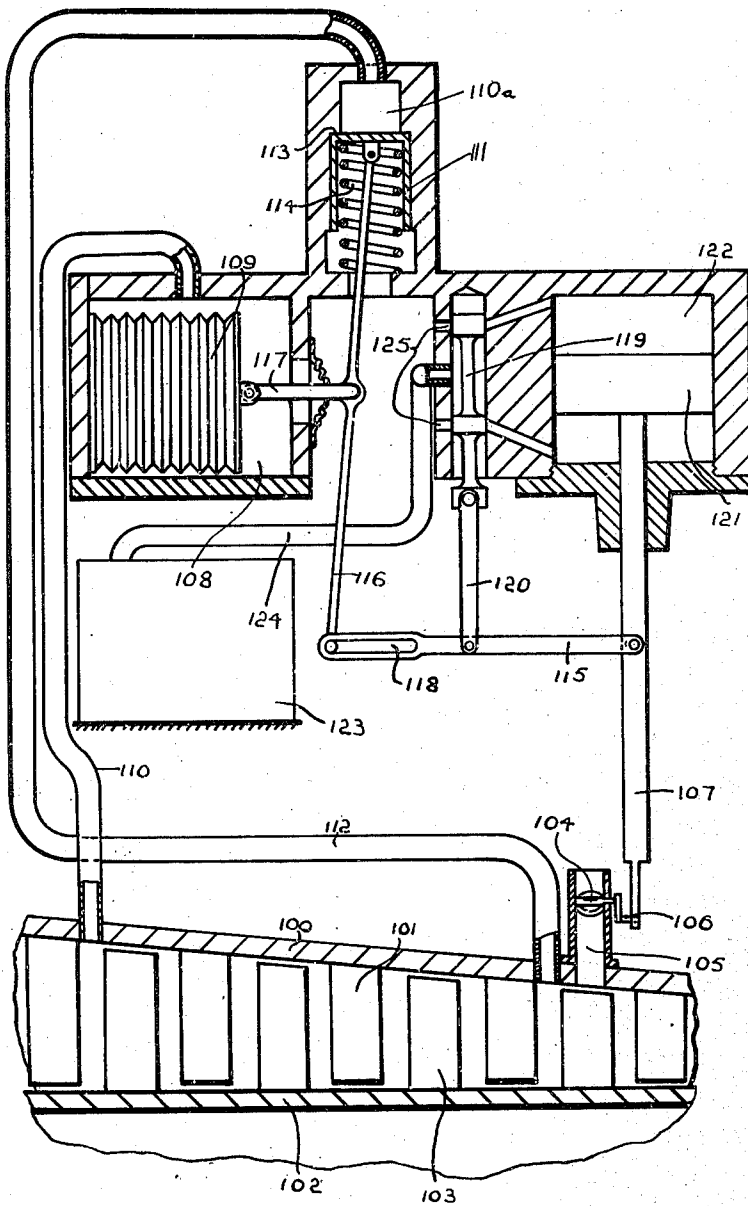
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REGULATION OF ROTARY COMPRESSORS

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REGULATION OF ROTARY COMPRESSORS

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4 Claims. (Cl. 230—115)

This invention relates to rotary compressors, and especially to axial-flow types of compressor, and particularly to such as form part of an internal-combustion jet-propulsion turbine plant.

Co-pending patent application Serial No. 495,525, filed July 20, 1943, in the names of F. A. M. Heppner and another, discloses the use of a fluid spill valve, for the compressor, which may be actuated automatically responsively to the compression ratio of some part of the compressor and which is fully open when the compressor is stationary and is gradually closed as the compressor speed increases, being fully closed when the designed compression ratio is reached.

Our main object is to provide improved control means for the spill valve of a rotary compressor.

This and other objects and advantages of the invention will be better understood if attention be directed to the following description, in which reference is made to the accompanying diagrammatic drawing the single figure of which is a fragmentary sectional elevation of a multi-stage compressor having a spill valve which is automatically regulated, according to the invention, dependently upon the absolute pressure ratio.

Broadly, in carrying out the invention, there is a means responsive to the pressure of the compressor at one place, a means responsive to the pressure in the compressor at a later stage, a fluid pressure servo device having a control valve which is worked by a lever, and a rod interconnecting the lever and the means responsive to the pressure in the compressor at the said later stage whilst the other means, responsive to the pressure of the compressor at the said one place, is connected to the rod intermediate its ends; such that the spill valve will be automatically regulated in the manner aforesaid.

In a preferred arrangement the servo means by which the fluid spill valve is actuated is controlled by a pair of bellows devices responsive, respectively, to the pressures at different points of the compressor, one of the said devices acting directly to control the servo means and the other acting to vary the leverage at which the said one device controls the servo means.

Referring now to the single figure of the drawing, this shows a compressor comprising a stationary casing 100 carrying sets of fixed blades 101, and a rotor 102 carrying sets of rotating blades 103. The spill valve is shown in the form of a throttle valve 104 disposed in a passage-way 105 communicating with the interior of the compressor, near the relatively-narrow outlet end

thereof. The throttle valve carries a crank 106 connected to a piston rod 107 to be actuated thereby.

In the present instance a chamber 108 containing an atmospheric capsule or bellows device 109 is in communication with a point near the intake to the compressor by a pipe line 110, and a chamber 110a containing a plunger 111, or this also may be a bellows device, is connected to a later stage by the pipe line 112. The plunger is held against a stop 113 by a spring 114 and operates a lever 115 through a connecting rod 116. This rod is positioned by the capsule 109 by means of a link 117. The lever 115, which has a slot 118 in one end, where it is engaged by a pin on the end of the connecting rod 116, operates a piston valve 119 through a link 120 and is connected to the piston rod 107 of a servo piston 121. Fluid pressure for the servo cylinder 122 can be supplied from a reservoir 123 along a pipe line 124, while the passages 125 are for exhaust purposes.

When the compressor is stationary at sea level the capsule 109 takes up a position according to the pressure at the compressor intake, and the plunger 111 is held against its stop by the spring 114 which offers a very low spring load. As the rotor starts the pressure in the compressor increases and the plunger 111 is depressed against the spring 114 and operates the piston valve 119 of the servo motor. The servo piston 121 will take up a position in direct proportion to the depression of the plunger 111. At a predetermined depression of the plunger the servo piston will come to the end of its stroke, when the spill valve 104 is fully closed.

If the pressure at the compressor intake is decreased the capsule 109 will become extended and this in turn will move the pin of the connecting rod 116 along the slot 118 in the lever 115 in a direction to shorten the leverage between the rod 116 and the piston valve 119. This has the effect of allowing the servo piston 121 to move the same distance as previously but for a shorter movement of the piston valve 119. But when the compressor again speeds up the pressure on the plunger 111 is increased and the latter is depressed and once again, at a smaller predetermined depression of the plunger, the servo piston will come to the end of its stroke.

Thus for any fixed ratio of pressure on the capsule 109 and plunger 111 the servo piston 121 will travel the full length of its stroke.

What we claim as our invention and desire to secure by Letters Patent of the United States is:

1. For a rotary compressor, a fluid spill valve

disposed between its ends, a means responsive to the pressure of the compressor at one stage, a means responsive to the pressure in the compressor at a later stage, a fluid-pressure servo device for actuating said spill valve, said servo device having a control valve, a lever for actuating said control valve, and a rod interconnecting said lever and said second means, said rod being connected intermediate its ends with said first means, such that said spill valve will be fully open when the compressor is stationary and will gradually close as the compressor speed increases, being fully closed when the designed compression ratio is reached.

2. In an axial-flow compressor, the combination of a fluid spill valve disposed between its ends, an axially-movable device responsive to the pressure of the compressor at an early stage, an axially-movable device responsive to the pressure in the compressor at a later stage, said devices movable in directions substantially at right angles to one another, a fluid-pressure servo device for actuating said spill valve, said servo device having a control valve movable in a direction approximately parallel to the direction of movement of said second device, a lever for actuating said control valve, a rod having a pin-and-slot connection with said lever, said rod connected to said second device and being substantially parallel to the direction of movement thereof, and said rod being connected intermediate its ends to said first device, such that said spill valve will be fully open when the compressor is stationary and will gradually close as the compressor speed increases, being fully closed when the designed compression ratio is reached.

3. In an axial-flow compressor, the combination of a fluid spill valve disposed between its ends, an axially-movable device responsive to the pressure of the compressor at an early stage, an axially-movable device responsive to the pressure in the compressor at a later stage, a fluid-pressure servo device for actuating said spill valve, said servo device having a control valve, a lever for actuating said control valve, and a rod connected intermediate its ends to said first device and connected at one end to said second device and connected at its other end to said lever in such manner that operation of said second device will actuate said member while operation of said first device will vary the leverage at which said rod acts on said lever, whereby said spill valve will be fully open when the compressor is stationary and will gradually close as the compressor speed increases, being fully closed when the designed compression ratio is reached.

4. In an axial-flow compressor, the combination of a fluid spill valve disposed between its ends, and servo means for actuating said spill valve whereby it will be fully open when the compressor is stationary and will gradually close as the compressor speed increases, being fully closed when the designed compression ratio is reached, said servo means being controlled by a pair of bellows devices responsive, respectively, to the pressures at different points of the compressor, one of said devices acting directly to control said servo means and the other of said devices acting to vary the leverage at which said one device controls said servo means.

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