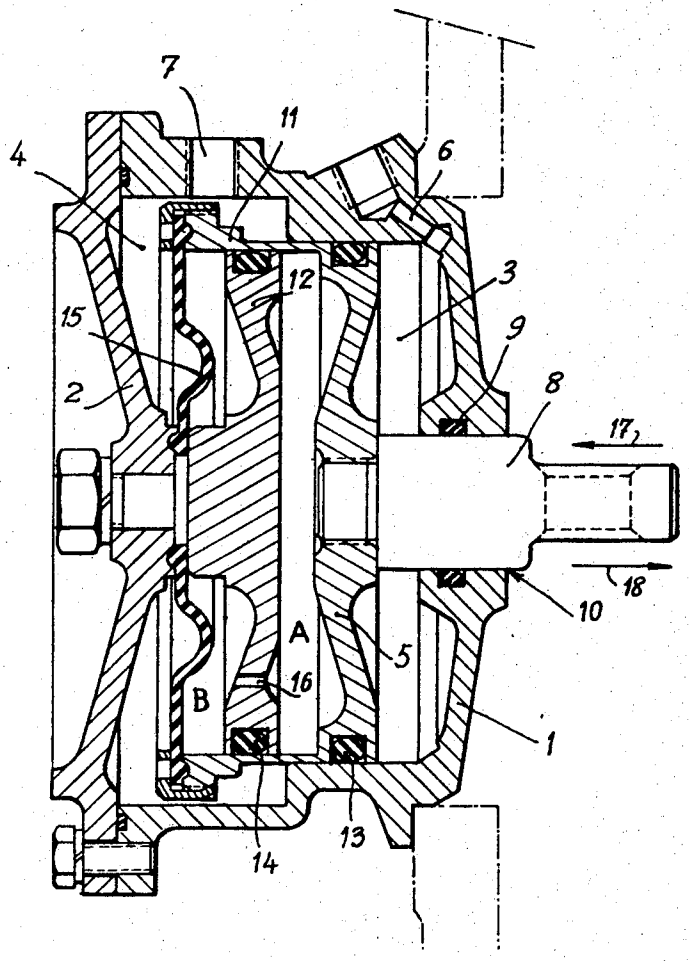
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PNEUMATIC DOUBLE-ACTING CONTROL DEVICES

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# PNEUMATIC DOUBLE-ACTING CONTROL DEVICES

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## ABSTRACT OF THE DISCLOSURE

A double-acting control device for use in such devices as pneumatic actuators, comprising a double-acting hollow piston having opposite ends which are respectively acted upon by pressure conditions in opposite ends of a chamber, the piston cavity in turn being subdivided into two axially opposite sealed compartments by a rigid stationary partition connected to the chamber housing, said piston cavity being defined by a rigid wall at one end of the piston and a flexible wall at its other end, damped flow being permitted between both piston compartments.

This invention is concerned with a double-acting control device and has specific reference to a pneumatic control piston-cylinder unit or actuator of which the primary characteristic is that it comprises a hydraulic damper incorporated in the control piston.

In the single figure of the attached drawing an axial section of the apparatus according to this invention is illustrated.

In this specific form of embodiment the device comprises a bell-shaped case **1** having at its open end a flanged edge to which a cover **2** is secured in a fluid-tight manner.

The sealed chamber thus obtained is divided into two portions **3** and **4** by a double-acting piston **5** adapted to be actuated by compressed air at the proper time either from port **6** or from port **7**. This piston **5** has a particular design in that it is rigid with a rod **8** adapted to transmit the piston movements to the device to be actuated. This rod **8** is slidably mounted through a suitable aperture **10** provided with a rod packing **9** in the end of said bell-shaped member **1** which is opposite to the cover **2**.

Opposite to said piston rod **8** is a skirt **11** of piston **5** which slides with its outer periphery in a cylinder-forming portion of the bell-shaped member **1**, the inner portion of said skirt **11** sliding along a fixed piston **12** rigid with said cover **2**.

The movable piston **5** is provided with a piston packing **13** and the fixed piston **12** with a piston packing **14**. A gauged orifice **16** is formed in the flange of the fixed piston **12**.

A diaphragm **15** has its central annular portion clamped between said fixed piston and the cover **2**, and its outer peripheral portion is clamped between a ring and the edge of said skirt **11** which is opposite to the rod **8**.

It will be noted that the fixed piston **12** constitutes a partition between chambers A and B filled with non-compressible hydraulic fluid, such as oil, any trace of gas being removed from these chambers.

This actuator operates as follows:

Assuming that the pressure in chamber **4** is *p*, compressed air is introduced through port **6** into chamber **3** at a pressure *p'*, greater than *p*.

Air pressure will thus move the piston **5** in the direction of the arrow **17** and force liquid from chamber



A to chamber B through the aforesaid gauged orifice **16**, thus damping the resulting piston movement.

The liquid flowing from chamber A to chamber B causes the volume of this chamber B to increase and this increment is permitted by the possible displacement and distortion of diaphragm **15**.

During the reverse movement, that is, in the direction of the arrow **18**, assuming that chamber **3** is at a pressure *p*, compressed air is introduced through port **7** into chamber **4** at a pressure *p'* greater than *p*; this pressure *p'* is exerted against the diaphragm **15** and thereby transmitted to the liquid contained in chamber B. Thus, the liquid in this chamber B flows back into chamber A through the gauged orifice **16** by damping the movement of the piston **5** which travels (in the direction of the arrow **18**) as the volume of liquid increases in chamber A.

From the foregoing it will be noted that:

(a) No contact between the gas and liquid media can take place, thus avoiding any risk of emulsion.

In this respect, it will be seen that the provision of a diaphragm **15** ensures a perfect fluid-tightness between the fixed portion **12** and the movable portion **5** of the device. The permissible movement and distortion of this diaphragm avoid the use of sliding or rotary packings.

(b) The liquid can expand freely in its cavity and the complete device is definitely fluid-tight.

(c) The absolute fluid-tightness of the device permits of dispensing with the use of an overflow reservoir, since the absence of leakages makes it unnecessary to make up for fluid losses.

Of course, the specific form of embodiment illustrated in the drawing and described hereinabove should not be construed as limiting the present invention since many modifications and variations may be brought thereto without departing from the spirit and scope of the invention.

Thus, notably, the surface area of piston **12** may be equal, superior or inferior to that of piston **5** in order to vary the magnitude of the damping action according to the direction of operation of the device.

I claim:

**1.** A double-acting control device for use in such devices as pneumatic actuators, comprising a housing defining a chamber having opposite axial ends, a double-acting hollow piston slidably mounted within said chamber and dividing same into respective opposite end compartments sealed from each other, said piston being defined by a rigid wall at one end thereof defining one of said end compartments with said housing, and a flexible wall at the other end thereof defining the other of said end compartments with said housing, a rigid partition attached to said housing and being located within said piston between the end walls thereof and thereby dividing the piston cavity into separate sealed compartments, damping means providing restricted intercommunication in either direction between said piston compartments.

**2.** The double-acting control device of claim **1**, wherein said housing has inner wall means defining said chamber, said partition being fixedly attached to said housing within said chamber and positioned at a point intermediate the ends thereof, said partition having an outer peripheral edge radially spaced inwards from said housing inner wall means, said double-acting hollow piston being axially slidable within said chamber, said piston having an outer wall portion slidable in sealed manner along said housing inner wall means and said piston having an inner wall portion slidable in sealed manner along the outer peripheral edge of said partition, said piston defining a cavity between said rigid and flexible walls, said partition being positioned within said piston cavity between said piston rigid and flexible walls

and thereby dividing said piston cavity into two axially opposed compartments, said flexible wall being formed by a flexible diaphragm having an inner radial peripheral end sealingly attached to said housing and an outer radial peripheral end sealingly attached to said piston, said piston dividing said housing chamber into respective axially opposed compartments, port means leading through said housing into each of said housing compartments.

3. The control device of claim 2, said partition comprising a radial wall portion and an axially protruding central hub portion, said hub portion being rigidly secured to said housing and defining therewith an annular space, said inner radial peripheral end of said diaphragm being sealingly gripped between said housing and hub portion in said space.

4. The control device of claim 2, said compartments in said piston cavity being adapted to hold hydraulic fluid therein in sealed manner relative to said housing chamber, and said housing chamber compartments being adapted to hold pressurized gas therein in sealed manner relative to each other.



5. The control device of claim 2, said damping means comprising an open bore of relatively small size extending through said partition between said piston compartments.


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U.S. Cl. X.R.

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