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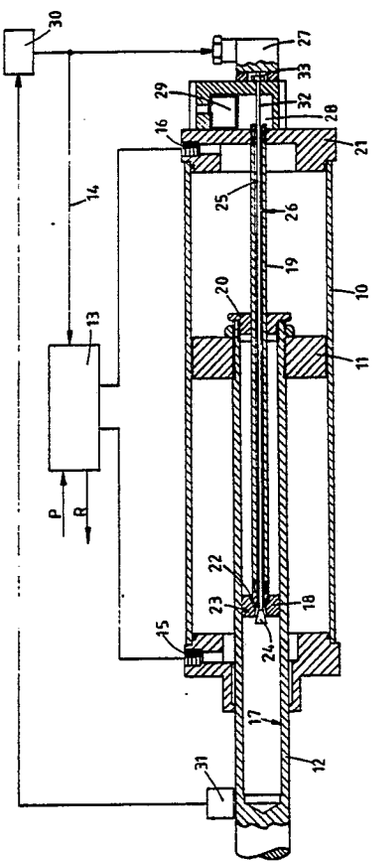
(54) Pneumatic actuator.

(57) A penumatic piston (11) has an output element (12) whose bore (17) provides a cylinder for a piston (18) which is secured to a fixed part (21) of the actuator and which has flow restrictors (22) through which hydraulic fluid is displaced as a result of movement of the output element (12). The restrictors (22) are normally shut by a valve (24) to provide a hydraulic lock which prevents movement of the output element (12). The valve (24) can be opened by an electro-magnetic actuator (27) which is energised in unison with a valve (13) through which actuating air is supplied to the piston (11).



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PNEUMATIC ACTUATOR

Pneumatic actuators have the advantage of clean operation and low cost and are therefore to be preferred for many applications. However, since such actuators are operated by a compressible working medium they have a number of disadvantages including:-

(i) movement of the actuator output does not cease immediately when gas control valves to the actuator are shut

(ii) the rate of movement of the output element does not correspond to the rate of gas flow to or from the actuator, and may be excessively high once static friction in the actuator has been overcome

(iii) the actuator output element can be displaced by outside forces away from its stopped position, even though the associated gas control valves are shut.

It is an object of the invention to provide a pneumatic actuator in which the foregoing disadvantages are overcome.

According to the invention there is provided a pneumatic actuator having an output element moved by a gas pressure difference, a hydraulic unit comprising a first piston and a first cylinder and a fluid flow restrictor, said unit being coupled to said output element so that fluid is displaced through said restrictor from one side of said first piston to the other side thereof as a result of movement of said output element, and a valve for shutting off flow between opposite sides of said first piston.

In a particular embodiment said first cylinder is defined by a bore in said output element, said first piston being slidable in said bore.

In a preferred embodiment said flow restrictor is provided in the head of said first piston, and said valve is operated by a stem extending through a bore in said first piston.

In a further preferred embodiment said actuator incorporates a reservoir for hydraulic fluid which communicates with one of the sides of said first piston by way of said valve.

An embodiment of the invention will now be described by way of example only and with reference to the accompanying drawing.

As shown in the drawing a pneumatic actuator comprises a relatively fixed cylinder 10 in which a piston 11 is slidable, a rod 12 of the piston 10 providing an output element of the actuator. Air flow to and from the actuator is controlled by a known type of solenoid valve 13 which is selectively operable by electrical signals on lines 14 to connect an air supply pressure P and a low return pressure R to ports 15, 16 in the cylinder 10, or to isolate both ports 15, 16 from the supply and return pressures.

The piston rod 12 has a bore 17 in which a piston head 18 is slidable. A rod 19 of the piston head 18 passes sealingly through an end cap 20 of the bore 17 and is secured to an end wall 21 of the cylinder 10. The head 18 has flow restrictors 22 through which hydraulic fluid in the bore 17 can flow, and a seat 23 for a valve 24 which is operable to shut off flow through the restrictors 22. The valve 24 has a stem 25 which extends with clearance through a bore 26 in the rod 19 and is axially movable by a solenoid 27 mounted on the wall 21. The stem 25 has a threaded end 32 engaged by a nut 33 by means of which a rate of flow past the valve 24, when the latter is open, may be preset to control the speed of the piston 11. The solenoid 27 is de-energised when the valve 13 is operated to isolate the ports 15, 16, and thereby to arrest the piston 11. Also mounted on the wall 21 is a reservoir 28 for hydraulic fluid, the reservoir 28 communicating with the bore 26. Fluid in the reservoir 28 is maintained under pressure by a pressurized gas in a sealed flexible container 29.

In use the piston 11 is movable in either direction in response to operation of the solenoid valve 13, the solenoid 27 having been operated to open the valve 24. Movement of the piston 11 is accompanied by displacement of hydraulic fluid through the restrictors 22, thereby imposing an upper limit on the speed of the piston 11. When the valve 13 is operated to isolate the ports 15, 16 the solenoid 27 is simultaneously de-energised to shut the valve 24. The piston 11 is immediately arrested by the hydraulic lock which occurs in the bore 17, and is restrained against any subsequent movement by that lock, so long as the solenoid 27 is de-energised. The arrangement provides a pneumatic actuator in which the position of the output element is closely controllable without the need for sophisticated detector or feedback devices. For example, a control circuit 30 for the valve 13 and solenoid 27 may be responsive to a position detector 31, for example a switch, which is responsive to the operating position of the output rod 12.

Claims

1. A pneumatic actuator having an output element (12) moved by a gas pressure difference, a hydraulic unit comprising a piston (18) a cylinder (17) and a fluid flow restrictor (22), said unit coop-

erating with said output element (12) so that fluid is disposed through said restrictor (22) from one side of said piston (18) to the other side thereof as a result of movement of said output element (12), and a valve (24) for shutting off flow between opposite sides of said piston (18).

2. An actuator as claimed in claim 1 in which said valve (24) is electromagnetically operated and is shut when de-energised.

3. An actuator as claimed in claim 1 or claim 2 in which said cylinder (17) is defined by a bore in said output element (12), said piston (18) being slidable in said bore.

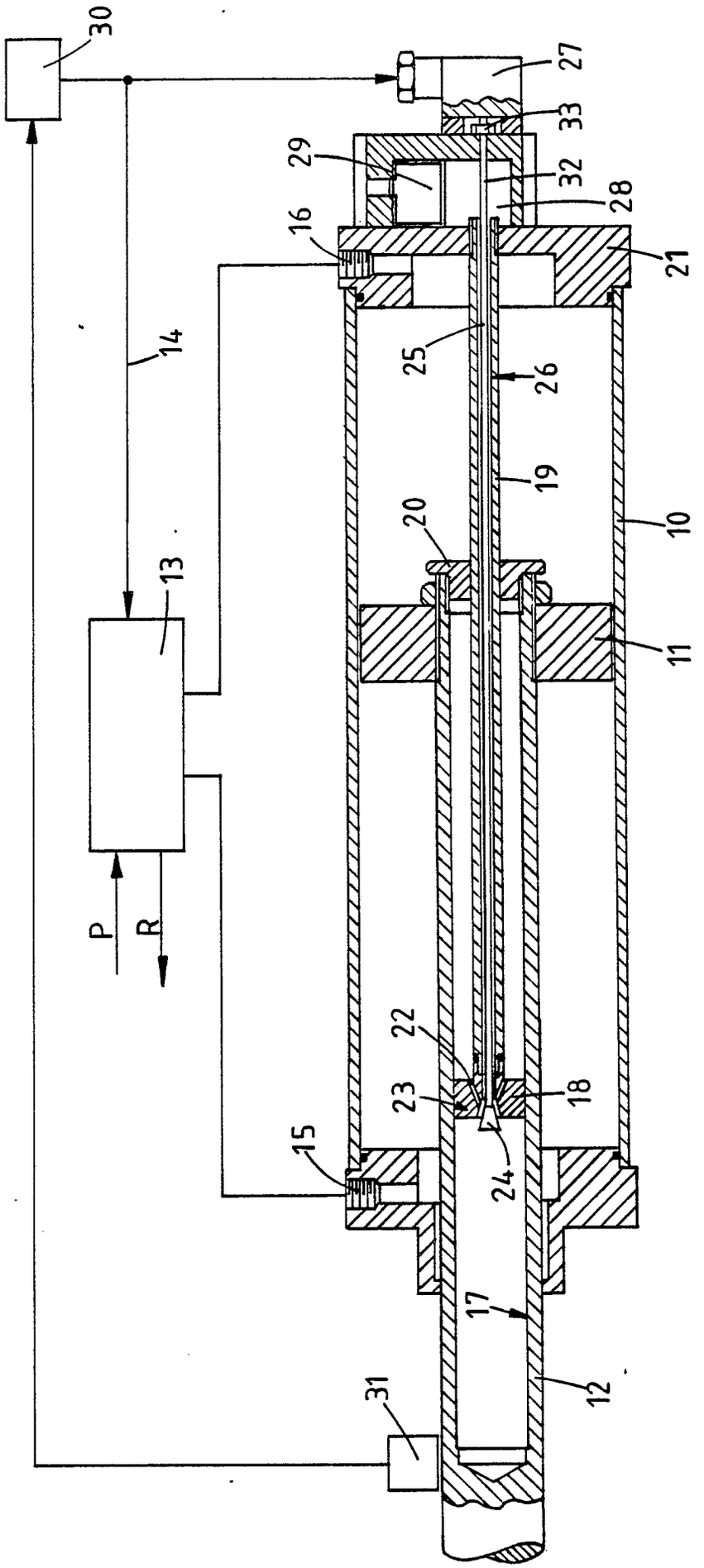
4. An actuator as claimed in any preceding claim in which said flow restrictor (22) is provided in the head of said piston(l8).

5. An actuator as claimed in claim 4 in which said valve (24) is actuated through a stem (25) extending through a bore in said piston (18).

6. An actuator as claimed in any preceding claim which includes a reservoir (28) for hydraulic fluid, said reservoir (28) communicating with one side of said piston (18).

7. An actuator as claimed in claim 6 in which said reservoir (28) communicates with said one side of the piston (18) by way of said valve (24).

8. An actuator as claimed in claim 6 or claim 7 in which said reservoir (28) is pressurized by gas.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EUROPEAN SEARCH REPORT

Application Number

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DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	FR-A-2 457 402 (STABILUS) * page 8, line 32 - page 15, line 15 *	1,3-6,8	F 15 B 15/26

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

F 15 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22-11-1988	KNOPS J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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