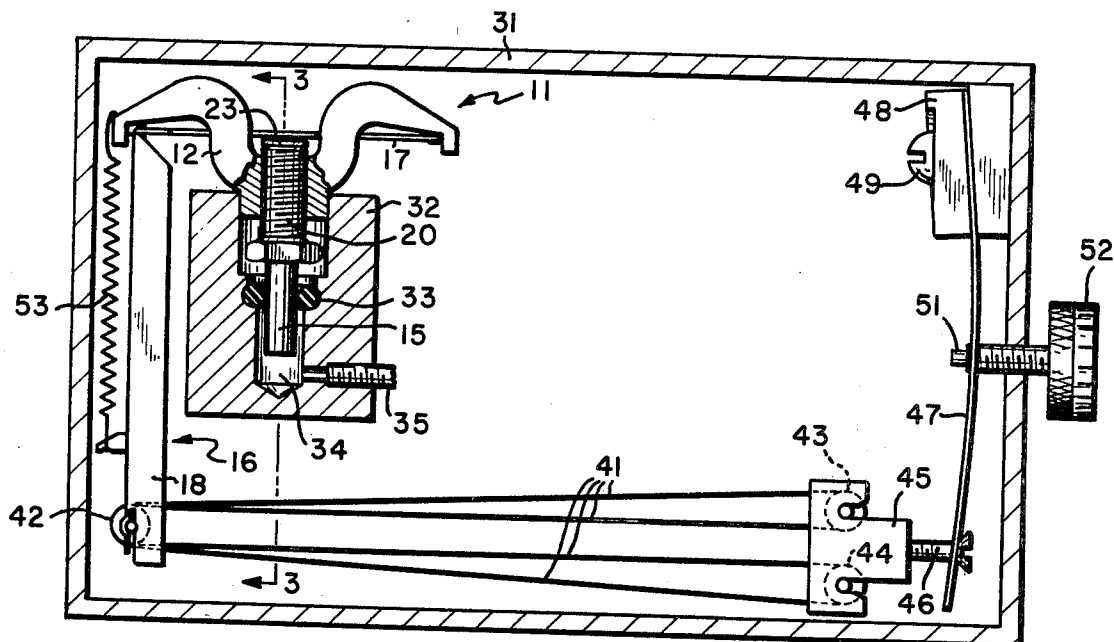


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 [21] Appl. No. **785,972**
 [22] Filed **Dec. 23, 1968**
 [45] Patented **Feb. 16, 1971**
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[56] **References Cited**
UNITED STATES PATENTS
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Primary Examiner—Alan Cohan
Attorneys—Lamont B. Koontz, Francis A. Sirr and John S. Summers

[54] **CONDITION CONTROL DEVICE**
 8 Claims, 5 Drawing Figs.
 [52] U.S. Cl. **236/44,**
 236/79, 137/82
 [51] Int. Cl. **F15b 5/00,**
 G05d 22/00
 [50] Field of Search 137/82, 85;
 236/44, 79

ABSTRACT: A pneumatic nozzle-flapper combination, the flapper of which is controlled by a flexible L-shaped lever simply supported at one end and at the corner. A nylon ribbon is operably connected to the free end of the lever, and in response to changes in relative humidity that portion of the lever between the supports undergoes a bowing movement with respect to the nozzle. This movement, which is directly in line with the nozzle axis, is utilized to valve air supplied to the nozzle, resulting in an output pressure signal that varies as a function of relative humidity.



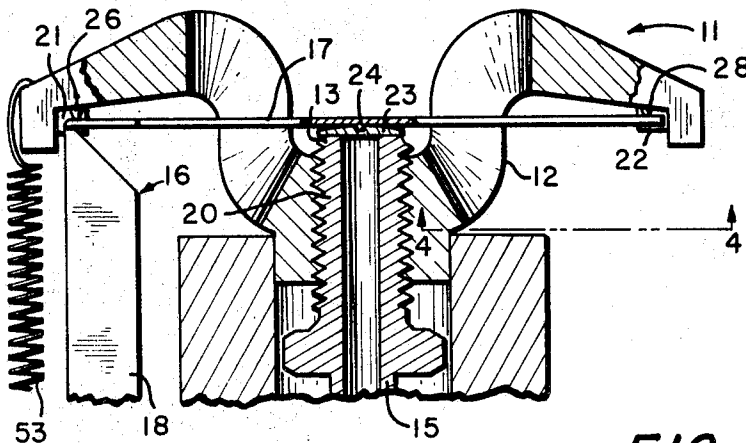


FIG. 1

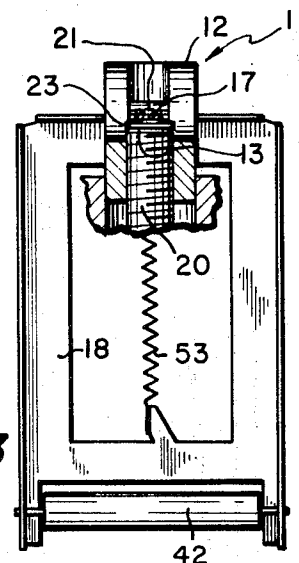


FIG. 3

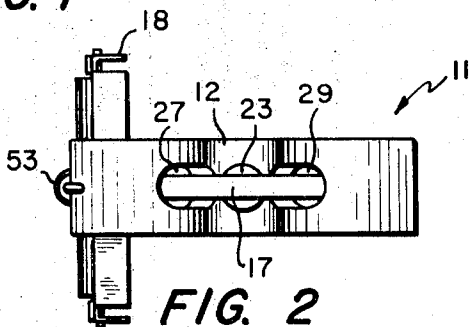


FIG. 2

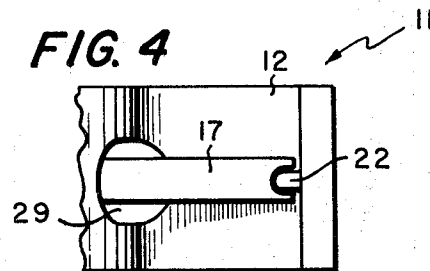
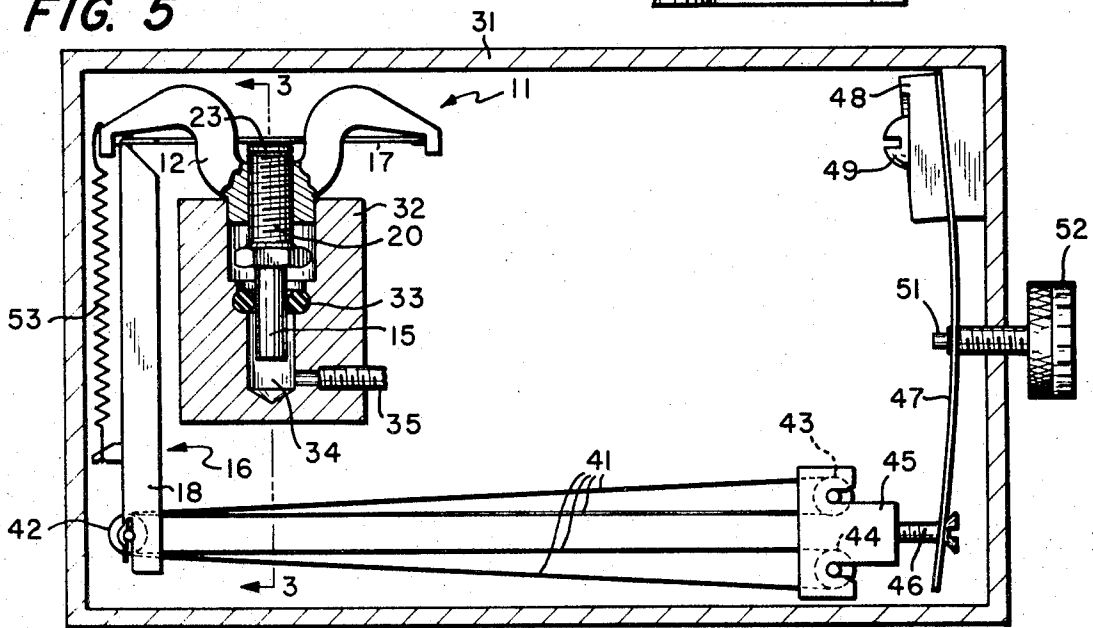


FIG. 4

FIG. 5



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CONDITION CONTROL DEVICE

BACKGROUND OF THE INVENTION

The trend in pneumatic control devices is generally to reduction in size. Pneumatic humidistats have not escaped the trend, but a unique problem exists due to the relative size and operation characteristics of humidity responsive elements. Nylon ribbon, for example, must be long to provide the dimensional change necessary to effect sufficient movement of a flapper with respect to a nozzle. Although the effective ribbon length can be shortened by plural windings the overall length remains relatively long, thus requiring a large device.

While the multiply wound ribbon does not have a substantial dimensional response, it does create a relatively strong force. Ideally, then, it is advantageous to mate this type of element with a pneumatic-valving arrangement that provides a wide signal pressure range in response to a strong but low motion force.

SUMMARY OF THE INVENTION

The inventive device employs a flexible lever simply supported at two points and adapted for connection at a third point outside the two points with a condition responsive motion or force, which gives rise to a bowing movement between the simple supports. This movement is employed to effect the valving of fluid pressure supplied through a nozzle and to thereby produce a control pressure signal. The device is particularly suited for use with a humidity responsive element having a low motion, low force characteristic.

Since the lever can be proportioned to produce movement that is in axial alignment with the nozzle rather than canted as with conventional cantilever-mounted flappers, the device is advantageously used with a large area nozzle such as the one disclosed in U.S. Pat. No. 3,174,499 issued to Richard C. Mott on March 23, 1965. The direct alignment feature allows a uniform gap to be maintained between the nozzle and flapper, thereby providing a well-controlled bleed for any flapper position. This is particularly important where large area nozzles are used. The feature exists notwithstanding the point on the lever at which the condition responsive element is connected.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front cutaway view of a nozzle-flapper combination embodying the invention;

FIG. 2 is a top view of the nozzle-flapper combination;

FIG. 3 is a side view of the nozzle-flapper combination;

FIG. 4 is a bottom view of the combination; and

FIG. 5 is a humidity responsive control device into which the nozzle-flapper pair is incorporated.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1—4 disclose a yoke-shaped support member shown generally at 11 having a recessed portion 12 that receives a nozzle member 20 the end of which forms a nozzle 13. Nozzle member 20 is threaded and adjustably screws into the support member 11. A thinned portion 15 of member 20 is adapted for connection with a source of fluid pressure as will be described below.

The support member 11 offers simple support to a single piece or integral L-shaped lever, shown generally at 16, which has a portion 17 of a given flexibility and a portion 18 of lesser flexibility. Portion 17 extends through openings 27, 29 formed in support member 11 and is held in position at support points 21, 22 which include fulcrum points 26, 28 respectively. The corner of lever 16 is slotted to fit over support point 21 and abut fulcrum point 26. Similarly, the free end of portion 17 is formed to fit over support point 22 and abut fulcrum point 28.

Disposed between the flexible portion 17 of lever 16 and nozzle 13 is a floating flapper or closure member 23, which is held in position by a small pin 24 extending from portion 17 into the flapper 23.

In operation, the existence of a force or motion applied to the less flexible portion 18 of lever 16 gives rise to a bowing movement within the more flexible portion 17 between fulcrum points 26, 28, which effects movement of the closure member 23 with respect to the nozzle 13 and causes valving of the fluid supplied thereto.

FIG. 5 discloses the nozzle-flapper combination embodied in a humidity responsive control device. The device has a base 31 which includes a receiving member 32 for nozzle member 20. The thinned portion 15 of the nozzle member 20 is inserted into the receiving member 32 through an O-ring 33 to form a pressure chamber 34. Fluid pressure is supplied to pressure chamber 34 by means of an inlet port 35. Support member 11 is secured to receiving member 32 by means not shown.

A humidity responsive force for the preferred embodiment is provided by a nylon ribbon 41, which is multiply wound to provide a greater force to lever 16 in response to changes in relative humidity. Other dimensional considerations for ribbon 41 include its width, which can also be varied to obtain a desired force to the lever 16, and the element thickness, which is held to a minimum to yield a faster time response.

Nylon ribbon 41 is placed in a state of tension by its connection between the free end of lever 16 and a setpoint leaf spring 47, which is mounted in cantilever fashion to base 31 by means of a clamping plate 48 and screw 49. Nylon ribbon 41 is connected to the free end of lever 16 by means of a roller 42, and to the setpoint spring 47 by means of rollers 43, 44, which are held in place by a connecting member 45. Member 45 is attached to setpoint spring 47 by a calibrating screw 46. Setpoint spring 47 can be adjusted by a screw 51 that is turned by an externally mounted knob 52.

In order to obtain a desired operating range for the device, a spring 53 is connected between supporting member 11 and the free end of lever 16. Spring 53 loads the lever 16 on fulcrum point 26 and thereby maintains a proper relationship between flapper 23 and nozzle 13 over the desired operating range.

In operation, the expansion or contraction of nylon ribbon 41 in response to changes in relative humidity exerts a moment at point 21 of the simply supported beam that controls the load on the nozzle-flapper pair and thereby modulates the pressure upstream of the nozzle 13. This modulated pressure can be calibrated by means of the screw 46 or adjusted by means of knob 52 and screw 51.

I claim:

1. In combination:

nozzle means adapted for connection with a source of fluid pressure;

means supporting the nozzle means including a base and an elongated member having a recessed portion, the nozzle means extending through the recessed portion;

lever means having a relatively flexible portion and a less flexible portion said relatively flexible portion being arranged for effecting valving of the nozzle means at an operating point intermediate its ends, means adjacent the end of said elongated member for holding said lever means at first and second points located on opposite sides of the operating point and defining an operating portion; condition responsive means operatively connected between the support means and the less flexible portion of the lever means at a third point disposed without the operating portion; and,

adjustable biasing means operatively connected between the condition responsive means and said base.

2. The combination as described in claim 1 wherein the base includes a receptacle into which the pressure connecting portion of the nozzle means is sealably inserted, the receptacle being adapted for connection with a source of fluid pressure.

3. In combination:

nozzle means adapted for connection with a source of fluid pressure;

means supporting the nozzle means;

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integral, L-shaped lever means having a first end, a corner
and a second end, the lever means simply supported by
the support means at the corner and the second end, the
corner and the second end defining therebetween a flexi-
ble operating portion for effecting valving of the nozzle
means; and,
condition responsive means adapted to exert a force on the
first end of said lever means and thereby a moment about
the corner of the lever means, which moment results in
the flexing of said operating portion and thereby the val-
ving of said nozzle means.
4. The combination as described by claim 3, further com-
prising a floating closure member disposed between the nozzle
means and the lever means, the closure member arranged to
operate in valving relationship with the nozzle means and
retained in its operating position by the flexible lever means.

5. The combination as defined in claim 4 and further com-
prising first biasing means operatively connected between the
condition responsive means and the support means, and
means for adjusting the first biasing means.

6. The combination as defined by claim 5, and further com-
prising a second biasing means connected to the support
means and the lever means and acting in opposition to the first
biasing means.

7. The combination as defined by claim 5, wherein the con-
dition responsive element is humidity responsive, and the
lever means and the first biasing means are arranged to place
the humidity responsive element in a state of tension.

8. The combination as defined by claim 7, wherein the hu-
midity responsive element is a nylon ribbon.

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