United States Patent

[11] 3,582,037

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[54] **PNEUMATIC LOGIC ELEMENT CONSTRUCTION**
2 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **251/61.1**
[51] **Int. Cl.** **F16k 7/12,**
F15c 3/04
[50] **Field of Search** 251/61.1,
331; 235/201

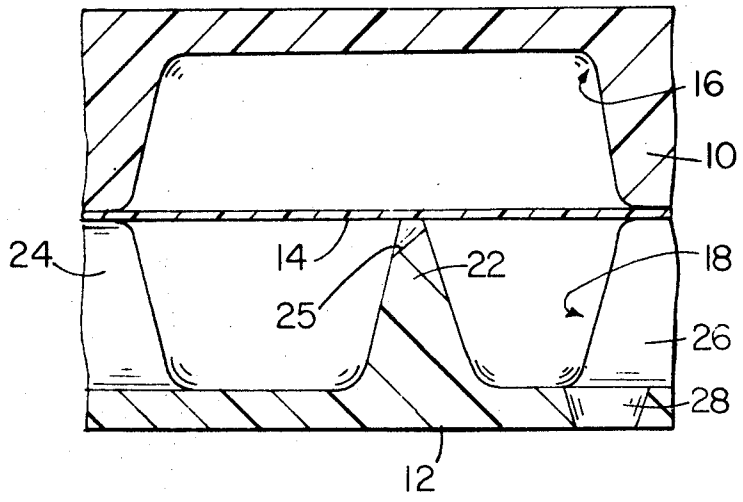
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2,186,833	1/1940	Iler	251/331X
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Primary Examiner—Arnold Rosenthal
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ABSTRACT: The disclosure of the invention is a ridge containing control chamber of a diaphragm-type pneumatic logic element having two plates stacked in facing relation and an interposed diaphragm, said control chamber comprising a supply pressure admission chamber recess formed in the face of one plate at one side of the diaphragm and a complementary ridge containing chamber recess with interconnecting channels to said ridge formed in the adjacent face of the other plate at the opposite side of the interposed diaphragm, in which the improvement is a control ridge, having a concaved curvature along its length to give more area for flow in the "ON" condition, and an upward taper to a sharp edge with an abrupt dropoff in the direction of flow which allows air flow to force the diaphragm away from the ridge to improve flow also in the "ON" condition.



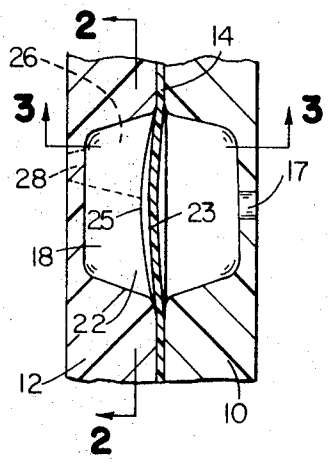


FIG. 1

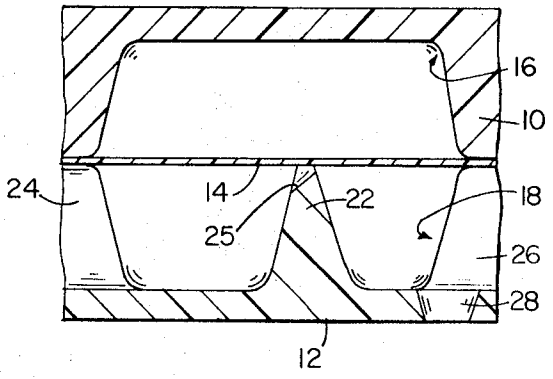


FIG. 3

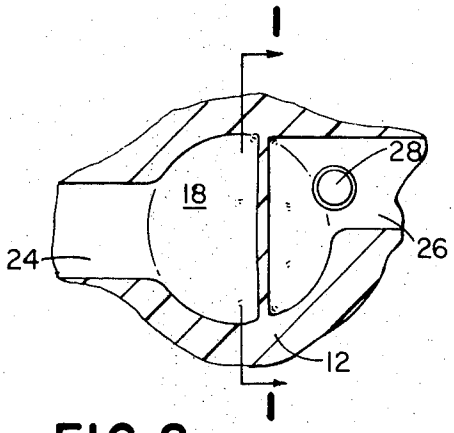


FIG. 2

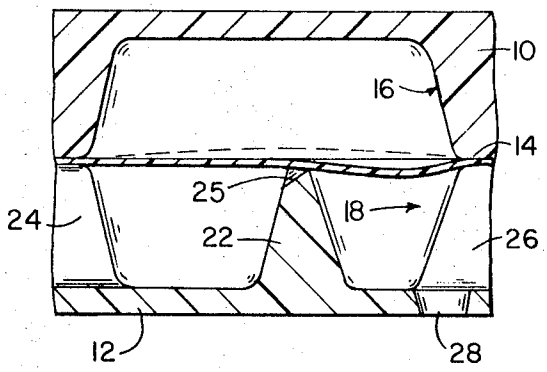


FIG. 4

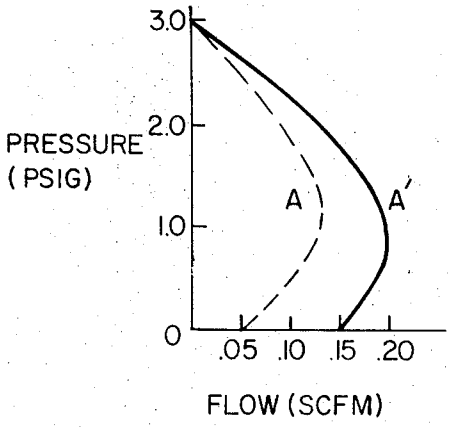


FIG. 5

PNEUMATIC LOGIC ELEMENT CONSTRUCTION

The present invention relates to an improvement in a diaphragm-type logic element, and more particularly to an improved control ridge forming an element of said logic element.

The diaphragm-type logic element is disclosed in the U.S. Pat. to Norwood, No. 3,318,329 issued May 9, 1967 for Fluid Operated Logic Devices. A logic element of this type may comprise generally two stacked plates with control chambers formed therein, of which each such control chamber comprises a pressure admission chamber recess formed in the face of one plate, a complementary control ridge containing chamber recess with interconnecting channels to opposite sides of said ridge formed in the adjacent face of the other plate, and a diaphragm secured between said faces separating said chamber recesses. The admission of signal or control pressure to the pressure admission chamber recess will press the diaphragm against the control ridge contained in the complementary chamber recess, thereby arresting the flow of supply pressure through the control chamber.

It is a principal object of the invention to provide a control ridge of improved construction for use in the output chamber of a diaphragm-type logic element, which will provide a substantially more rapid, clean-cut shift between the "OFF" and "ON" conditions, and a substantially increased flow for the "ON" position of the logic element.

With the above and other objects in view as may hereinafter appear, features of the improved output ridge include a concaved or scooped contour of the ridge along its length, which allows proper closing at the control ridge but gives more area for flow in the "ON" condition, and a sharply tapered edge having an abrupt dropoff in the direction of flow, which has the effect of allowing the airflow to force the diaphragm away from the ridge and thereby giving an increase of said flow through the logic element when the diaphragm is moved to the "ON" position.

Another feature of the improved control ridge consists in the greatly reduced area of contact between the diaphragm and ridge, which area of contact tends, especially when oil is present, to retard the release of the diaphragm from the control ridge to the "ON" position.

The several features of the invention will be readily appreciated by one skilled in the art from the following description taken in connection with the accompanying drawing, in which

FIG. 1 is a detail sectional view in side elevation of a control chamber for use in a diaphragm-type logic element, illustrating the contoured control ridge, and the diaphragm in contact with the ridge;

FIG. 2 is a plan view of the ridge containing chamber recess shown in FIG. 1;

FIG. 3 is a section taken on a line 3–3 of FIG. 1, but on a further enlarged scale, the diaphragm being shown in the relaxed position;

FIG. 4 is a view similar to FIG. 3, the diaphragm being shown in full lines in the "OFF" position, and in dotted lines in the "ON" position; and

FIG. 5 is a graph in which are plotted comparative nor gate output flow characteristics with and without the improved output ridge of the present invention.

Referring more specifically to the drawing, an output ridge containing control chamber is illustrated, which is similar to

the upstream chamber 32 with its output ridge in the output circuit as shown in FIG. 3 of the Norwood U.S. Pat. No. 3,318,329 and which is suitable for use in a nor diaphragm-type logic element, having a top plate 10, a bottom plate 12, a diaphragm 14 interposed therebetween, and control chambers with interconnecting passages comprising pairs of complementary chamber recesses 16 and 18 formed in the facing surfaces of the two plates. The chamber recess 16 shown is connected with control pressure through a port 17. The complementary chamber recess 18 shown contains an output ridge 22, is connected to supply pressure by means of an interconnecting channel 24, and is further provided with an outlet interconnecting channel 26. An inlet-outlet passage 28 connects with the output ridge containing chamber recess 18 adjacent the outlet interconnecting channel 26.

The output ridge 22 which forms more particularly the subject matter of the invention is given a concaved curvature as at 23 along its length to provide more area for flow of air between the ridge 22 and the diaphragm 14 when in the "ON" position shown in dotted lines in FIG. 4. As best shown in FIGS. 3 and 4 the top edge of the vent ridge is tapered upwardly as at 25 to a sharp edge providing an abrupt dropoff in the direction of flow from left to right as viewed in FIGS. 3 and 4. The output ridge formed in this manner has a line contact only with the diaphragm in the "OFF" position of FIG. 4 and also forms a space with the diaphragm which is open widest upstream so that airflow can force the diaphragm quickly to the "ON" position when control pressure is released.

While the control chambers of the fluid logic element including the ridges contained therein are of small size measuring normally less than a quarter of an inch across, the shape of the output ridge employed has been found to be of considerable importance in determining the overall efficiency of the logic element.

The improvement effected in NOR gate output flow characteristics of the improved output ridge having a longitudinal scoop and an upwardly tapered edge with an abrupt dropoff, as compared with the previously employed straight vent ridge with a rounded edge, is shown graphically in FIG. 5, in which pressure p.s.i.g. (pounds per square inch, gage) is plotted against flow s.c.f.m. (standard cubic feet per minute). The characteristic curve of the output, assuming a 3.0 p.s.i. gate supply and an output ridge having no scoop is shown at A in dotted lines. When a scooped output ridge is employed, the characteristic curve is that shown in full lines at A', indicating a substantial increase in gate output especially at the starting low pressure end of the curve.

What I claim is:

1. In a pneumatic logic element having two plates disposed in opposed facing relation, said plates having complementary pairs of chamber recesses and interconnnecting channel recesses formed in said opposed faces providing a flow channel across said chamber recesses, a flexible diaphragm interposed between said plates, and means for holding the two plates and interposed diaphragm together, the combination of a control ridge disposed across said flow channel, having a concaved curvature along its length, and having the edge thereof tapered upwardly to a sharp edge with an abrupt dropoff in the direction of flow.

2. A pneumatic logic element according to claim 1 in which the concaved edge is formed with a taper extending upwardly in the direction of flow from one side to the other of the ridge.