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NASA TECH BRIEF

Langley Research Center

Wall Attachment, Flueric Crossover "AND" Gate

A new, improved flueric "AND" gate using the wall attachment principle has been designed. Tests indicate that its performance is not adversely affected by normal dimensional variations encountered in fabrication, and that it will operate throughout the full range of loading from full open to blocked output.

This new "AND" gate resulted from removing the supply input and one control port from each of two identical monostable wall attachment amplifiers, and then joining the two units to form a passive element with two inputs and three outputs. The monostable amplifier used is shown in Figure 1.

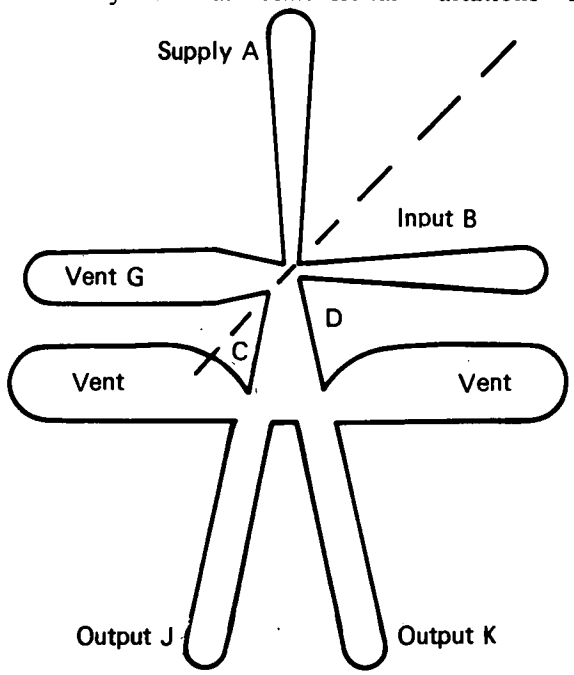

Figure 1. Schematic of a basic monostable wall attachment amplifier.

The mirror image is joined along the dashed line to form the "AND." In the basic amplifier, the supply is A and the control port is B. Since this active amplifier is monostable, flow from A attaches to wall C when signal B is present. If A is always present, the outputs indicate B or $\bar{B}$. If the unit is considered passive with inputs A and B, the outputs indicate $A \cdot B$ or $A \cdot \bar{B}$. The foregoing indicates the inherent ability of the monostable wall attachment unit to perform the "AND" function.

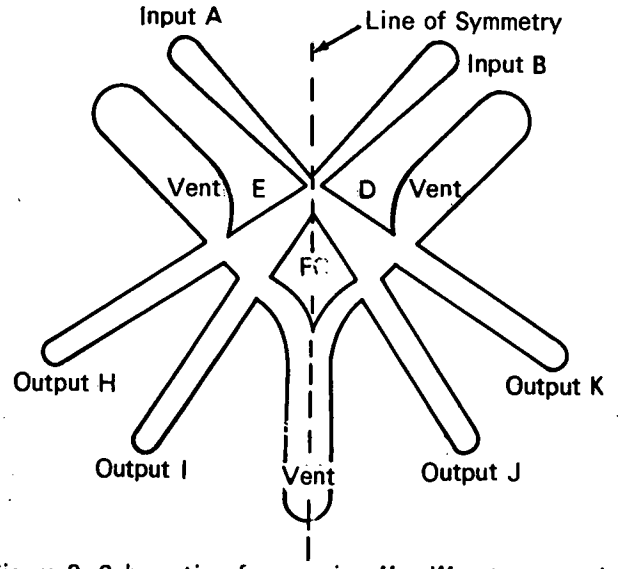

Figure 2. Schematic of a passive "and" gate created by the joining of two monostable wall attachment amplifiers.

Joining two of the basic amplifiers along the dotted line shown in Figure 1 and combining the internal vents results in a unit such as that shown in Figure 2. Note the dotted line of symmetry. By providing a summing junction for chan-

(continued overleaf)

nels I and J, the unit shown in Figure 3 will be produced. Walls C and D and input channels A and B form a monostable device as in Figure 1, so that B acts as the control of supply A. Walls E and F and input channels A and B form another monostable device which is the mirror image of that in Figure 1, where A now acts as the control for supply B. Since the configuration is monostable, flow from A only attaches to wall D, leaving through port K and yielding function $A \cdot \bar{B}$. Also, a flow appearing only at B attaches to wall E, leaving via port H and yielding the function $\bar{A} \cdot B$. When both A and B appear, simultaneous attachment to walls C and F is obtained, thereby forming the "AND" function $A \cdot B$ at outputs I and J. Combining these two channels gives this unit the attractive feature of providing an "AND" output when either input signal is considerably weaker than the other. A simple "Y" connection has been used successfully, and it is possible that channel modifications would improve the summed output of channels I and J.

Three essential features of this fluid "AND" gate are: (1) The flow from one control must be sufficiently monostable to allow initial attachment and, upon switching, return to the outer wall; (2) the flow splitter formed by the two interior attachment walls must be close to the input streams to prevent flow oscillations across it; and (3) venting must be adequate.

Figure 3 shows a practical modification of the original vent as shown in Figure 2. Most monostable fluidic amplifiers can be used to produce workable "AND" gates, and in general the "AND" gate produced will have the output and switching characteristics of the amplifier used to produce it.

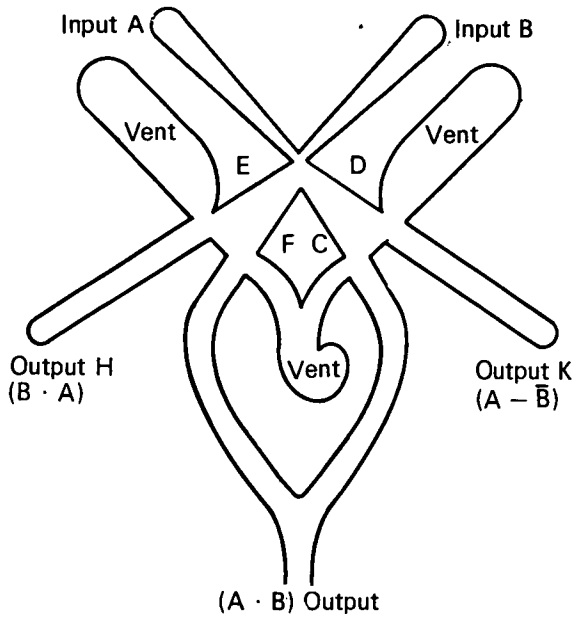

Figure 3. Schematic of "and" gate with summing junction for (A · B) output.

Note:

Requests for further information may be directed to:

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Reference: TSP71-10178

Patent status:

This invention has been patented by NASA (U.S. Patent No. 3,493,004), and royalty-free license rights will be granted for its commercial development. Inquiries about obtaining a license should be addressed to:

Patent Counsel
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