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COMBINED STREAM INTERACTION AND TURBULENT AMPLIFIERS

Filed Oct. 23, 1965

FIG. 1

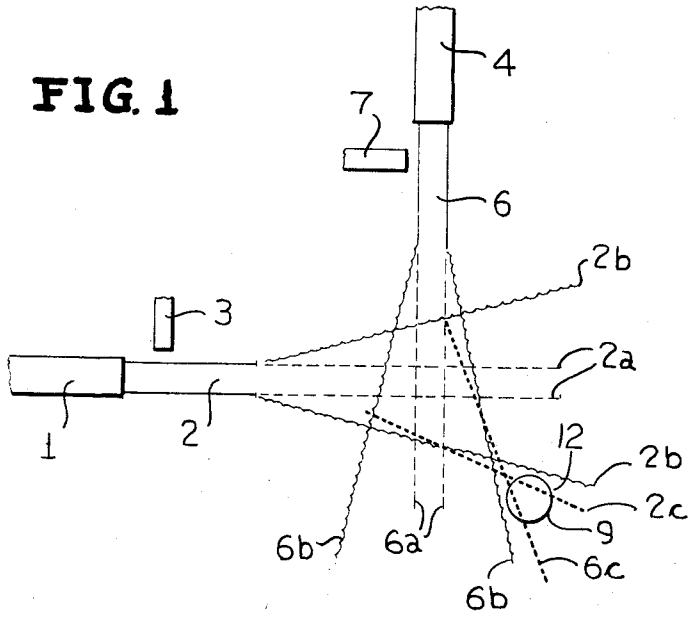
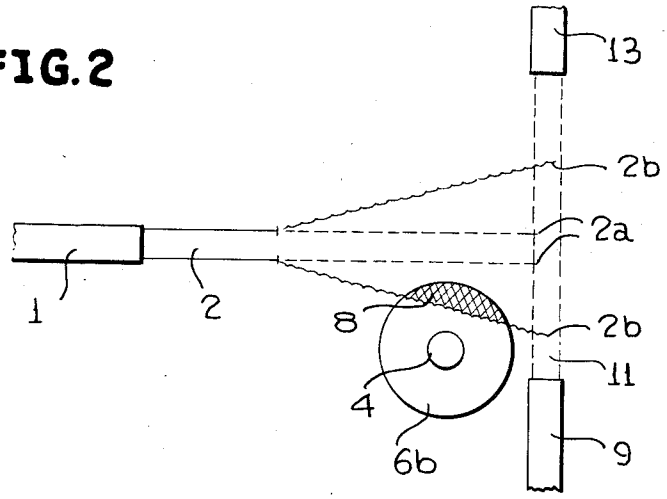


FIG. 2



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COMBINED STREAM INTERACTION AND TURBULENT AMPLIFIERS

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ABSTRACT OF THE DISCLOSURE

A fluid amplifier comprising means for issuing a pair of angularly disposed, normally laminar streams of fluid and means for selectively rendering said streams of fluid turbulent, said streams intersecting one another only when both said streams are turbulent, and means for issuing a third normally laminar fluid stream along a path such that the third stream is rendered turbulent only when said first and second streams are concurrently rendered turbulent.

The present invention relates to fluid amplifiers.

It is an object of the present invention to provide a fluid amplifier employing the combined principles of stream interaction and turbulence amplifiers.

It is another object of the present invention to provide a pure fluid AND gate employing the combined principles of stream interaction and turbulent amplifiers.

The above and still further objects, features and advantages of the present invention will become apparent upon consideration of the following detailed description of one specific embodiment thereof, especially when taken in conjunction with the accompanying drawing, wherein:

FIGURE 1 is a view in one plane of the amplifier of the present invention; and

FIGURE 2 is a view of the apparatus in a plane perpendicular to the plane of FIGURE 1.

Referring specifically to the figures of the accompanying drawing, a first passage **1** is adapted to issue a stream of fluid **2** which is normally a laminar flow stream. In accordance with the well known principles of turbulence amplifiers the stream **2** may be rendered turbulent by directing a low intensity control flow against the stream **2**. Such a control flow may be applied through a passage **3**.

When the stream is laminar it follows a path defined by the dashed lines **2***a*. When the stream is turbulent it follows the path defined by wavy lines **2***b*.

A second passage **4** is adapted to issue a normally laminar stream **6** generally transverse to the stream **2**. The passage **4** is located below, as viewed in FIGURE 2, the passage **1** to an extent to be indicated subsequently. The stream **6** when laminar follows a path defined by dashed lines **6***a*, and when rendered turbulent by a low intensity signal issued from a passage **7**, follows a path defined by wavy lines **6***b*.

The passage **4** is located a distance below passage **1** such that the turbulent stream **2***b* does not contact laminar stream **6***a* and turbulent stream **6***b* does not contact laminar stream **2***a*. However, if both streams are turbulent they intersect in a region **8** indicated by cross-hatching in FIGURE 2.

Referring again to FIGURE 1, a third passage **9**, perpendicular to passages **1** and **4** is adapted to issue a third normally laminar stream **11** through a region **12**. The region **12** is defined by the right line **6***b* and the lower line **2***b* of FIGURE 1 and thus lies out of the path of turbulent streams **2***b* and **6***b* when only one one of the streams is turbulent. A fluid receiver **13** is aligned with

passage **9** and when the stream **11** is laminar, a large flow is developed in receiver **13**.

When both of the streams **2** and **6** are rendered turbulent, a momentum interchange takes place in the region **8** of overlap of the streams. The overlapped portion of stream **2***b* is moved downward as indicated by dotted line **2***c*. Concurrently the overlapped portion of stream **6***b* is moved to the right as indicated by dotted line **6***c*. Thus when both and only when both **2** and **6** are concurrently rendered turbulent, the stream **9** is rendered turbulent and flow to the receptor **13** is drastically reduced. The above statement is, of course, a definition of the classical AND function.

While I have described and illustrated one specific embodiment of my invention, it will be clear that variations of the details of construction which are specifically illustrated and described may be resorted to without departing from the true spirit and scope of the invention as defined in the appended claims.

What I claim is:

1. A pure fluid amplifier comprising means for issuing a first normally laminar stream of fluid, means for issuing a second normally laminar stream of fluid at an angle to said first stream such that said streams cross one another in space, means for rendering said streams turbulent, said means for issuing being located such that said stream intersect one another only when both said streams are turbulent, further means for providing a fluid pressure output signal having a first pressure level in response to both said first and second streams being turbulent and a second pressure level in response to only one of said first and second streams being turbulent.

2. The combination according to claim **1** wherein said further means comprises: means for issuing a third stream along the path such that said third stream is rendered turbulent only when said first and second stream are turbulent, and means for receiving substantially all of said third stream when laminar and only a portion thereof when turbulent.

3. The combination according to claim **1** wherein the intersecting portions of said streams produce deflection of one another and increased turbulent spreading thereof.

4. A pure fluid amplifier comprising:

means for issuing first, second and third normally laminar streams of fluid;

means for selectively rendering said first and second streams fluid turbulent;

said means for issuing being disposed such that none of said streams intersect when all are laminar, such that said first and second streams intersect only when both are turbulent, and such that said third stream is rendered turbulent only when said first and second streams are concurrently turbulent.

5. The combination according to claim **4** wherein the intersecting portions of said first and second streams produce mutual deflection and increased turbulent spreading thereof.

6. A pure fluid amplifier comprising means for issuing a first normally laminar stream of fluid, means for issuing a second normally laminar stream of fluid at an angle to said first stream such that said streams cross one another in space, means for rendering said streams turbulent, said means for issuing being located such that said streams intersect one another only when both said streams are turbulent, and further means for issuing a third laminar stream of fluid along a path such that said third stream is switched between turbulent flow and laminar flow in response to both said first and second streams being turbulent.

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