

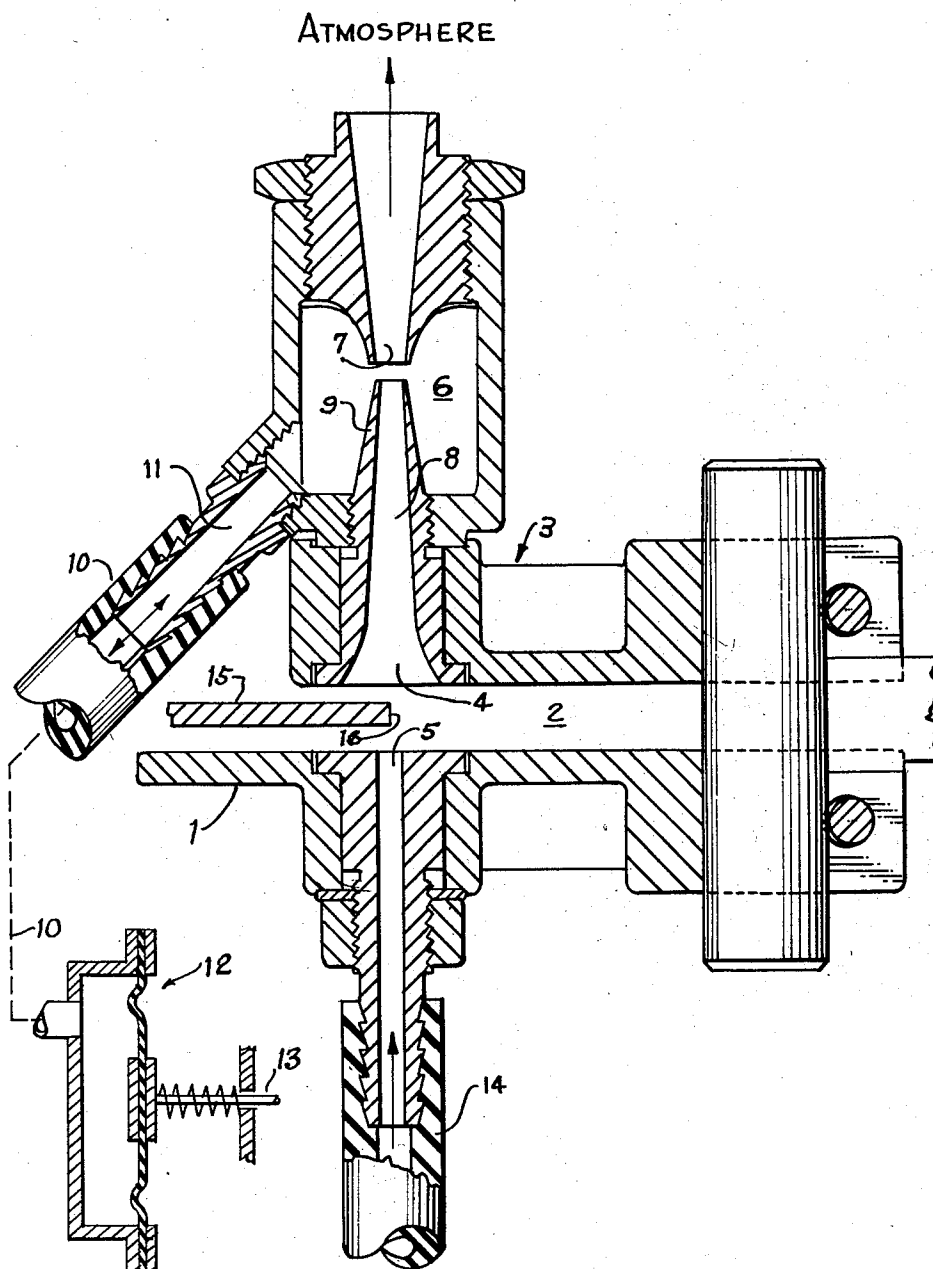
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WEB EDGE POSITION SIGNAL GENERATOR

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## WEB EDGE POSITION SIGNAL GENERATOR

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5 Claims. (Cl. 137—83)

In its broadest aspect, the present invention relates to the art of automatic development of a variable pressure signal by altering a condition of a jet of fluid, gaseous or liquid, as it traverses a sensing region through which it is discharged in unconfined condition as distinguished from confinement within a conduit, the jet being discharged at considerable velocity and with substantial kinetic energy toward a receiver port, and the receiver port constituting an aperture in the system wherein the signal pressure is developed and utilized. The condition of the jet stream that is altered in the sensing region, and the manner of its alteration are such as to vary the volume flow rate of the fluid of the jet that actually reaches, or impinges upon the receiver port mouth, the magnitude of the signal pressure being determined by the kinetic energy of that fluid. Ordinarily the alteration of the jet condition is such as to vary the cross sectional areas of portions of the jet that respectively impinge and do not impinge on the receiver port mouth, and the volume flow rate of the portion that does reach the port mouth, and the kinetic energy of that portion determine the magnitude of the signal pressure.

Heretofore, it has been the conventional practice to utilize a closed system for development, transmission and translation of the signal pressure, the signal pressure magnitude being determined by the kinetic energy of the jet portion impinging at the receiver port upon the fluid content of the closed system.

The present invention is based upon a concept of signal pressure development by a sensing jet that is a radical departure from the conventional arrangement providing for impingement of the jet or a portion of the jet upon the mouth of a receiver port opening of a closed system. Practice of the invention embraces delivery of the jet fluid reaching the port to and through an aspirator chamber which the fluid traverses in jet form, whereby magnitude of pressure within the chamber at any time is determined by the volume flow rate of the jet stream traversing the chamber. This chamber pressure is utilized as the signal pressure.

A significant difference between the conventional, closed system for signal pressure development and the aspirator system presented by this invention is that in the former the signal pressure magnitude varies in a direct proportional relation to volume flow rate of jet fluid impinging on the receiver port mouth, while in the aspirator system the signal pressure magnitude varies inversely with the volume rate of flow of sensing jet fluid entering the receiver port and traversing the aspirator chamber.

For disclosure of the invention, the field of lateral edge position detection has been chosen, because in certain situations in that specific field the invention presents a peculiar advantage that eliminates a problem that has been serious in certain situations. In edge position detection by a sensing fluid jet, the jet is delivered through a region wherein the marginal portion of a body adjacent an edge of the body, of which edge the lateral po-

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sition is to be detected and indicated by magnitude of signal pressure, that marginal body portion intercepting more or less of the sensing jet in correspondence to the lateral position of the edge, and consequently varying the volume flow rate of jet fluid passing by the edge and reaching the receiver port mouth toward which the jet is directed. The problem arises in situations wherein loose material is present, as air borne lint or similar matter, flying material that may be flung off by the body when it is a moving web, or foreign material carried by the body in a form permitting it to be picked up by the unintercepted portion of the jet. In detection by the conventional closed system any such material that enters the receiver port mouth tends to work into the system, collect therein and seriously diminish its sensitivity and accuracy. In the aspirator system of the present invention any such material is simply carried by entrainment in the stream of fluid entering the port, traversing the aspirator chamber and exhausting freely from it, so that the system is completely and continuously self-cleaning, and foreign material present at the receiver port, or carried to it by the jet, does not collect in and clog the system.

A primary object of the invention is provision of a novel arrangement for developing a signal pressure the magnitude of which is determined by the volume flow rate of the fluid content of a sensing jet that is directed through a sensing region toward a receiver port, and a condition of which is affected within the sensing region to vary the volume flow rate of fluid reaching the port in correspondence to degree in which that condition is affected.

Another object is the provision of a novel signal pressure developing system comprising an aspirator arrangement for directing the portion of the sensing jet that reaches the receiver port through and from the signal chamber as a high velocity stream that varies the signal pressure by withdrawing fluid from the chamber, and as a function of the volume flow rate of the stream.

Another object of the invention is provision of a novel and peculiarly effective device for developing a signal pressure the magnitude of which indicates the lateral position of an edge of a body that partly intercepts a fluid sensing jet, the unintercepted portion of which is directed to a receiver port that communicates with a signal pressure development chamber.

Still another object is the provision of a novel, self-cleaning detector of the type in question.

The accompanying drawing is a median section through a detector assembly provided with a signal pressure developing arrangement embodying the invention.

Describing the drawing in detail, a first structure 1 is arranged to discharge a jet across a sensing region 2 toward a receiver structure 3 that is provided with a receiver port 4 toward which the jet discharge from an orifice 5 in structure 1 is directed, for receiving a part of the jet that is determined by the degree of alteration of a condition of the jet that affects the volume rate of flow of jet fluid reaching port 5. Within receiver structure 3 is a signal pressure chamber 6 that communicates with port 4 for development of a pressure in chamber 6 the magnitude of which is determined by the portion of the cross section of the jet that impinges upon the mouth of port 4.

In accordance with the invention, and as a distinct and radical departure from the prior practice of arranging the signal pressure chamber as an element of a closed pressure system, the volume of which is variable only by variation of the volume of the chamber of an expandable chamber translator device, in the arrangement shown chamber 6 is provided with an exhaust opening 7 that vents to a low pressure region of exhaust, such as atmos-

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where, and that is in alignment with receiver port 4 and an axially straight passage 8, so that fluid entering the port, which it does at considerable velocity, is directed through chamber 6 and exhaust opening 7 in the form of a stream. The aspiration effect of this stream withdraws fluid from chamber 6, lowering pressure thereof to a degree that is a function of the volume rate of flow of the stream, and consequently of the degree to which the jet has been altered in region 2. Consequently the magnitude of pressure of the fluid medium in chamber 6 affords a reliable indication of the degree of jet alteration.

Preferably the structure of the receiver is arranged to insure production of the aspiration effect of the jet stream as it crosses through and from chamber 6. To this end, passage 8 is shown as being axially formed to increase velocity of the fluid stream as it is discharged into and across chamber 6, specifically by progressive decrease of the cross section of passage 8 from port 4 to chamber 6, and the provision of a discharge nipple 9 that projects into chamber 8 toward exhaust opening 9.

A coupling is provided for a signal pressure transmission line 10, enclosing a pressure duct 11 that opens into chamber 6 in a region where it is shielded from possible turbulence effects created by the aspiration stream as it crosses the chamber, as by being located externally of, but close to nipple 9, whereby pressure transmitted by duct 11 corresponds to static pressure of fluid within chamber 6. This pressure may be translated to a stroke or force, as by an expansible chamber assembly 12 having an output transmission rod 13.

It will be readily appreciated that, since signal pressure magnitude depends on aspiration by the stream of fluid flowing through port 4, passage 8 and exhaust port 7, rather than in pressure increase in a closed system by impingement of the jet on a receiver port, that in the arrangement provided by the invention there can be no development of a false condition, corresponding to the negative pressure condition that sometimes develops in the closed, positive pressure systems of the prior art, in other words, the sign or sense of the signal cannot be reversed with respect to atmospheric pressure.

Similarly it will be apparent that any air borne material carried into receiver port 4 will be entrained and carried by the stream completely through passage 8, chamber 6 and exhaust opening 7, materially reducing the possibility of progressive deposit of such material in the signal system.

It will now be seen that, with fluid such as air supplied to discharge orifice 5, as by a line 14, the signal pressure effective in chamber 6, and transmitted by conduit 10 is a function of volume rate of flow of fluid through port 4, passage 8, chamber 6 and port 7.

In the specific edge position detector shown, region 2 is in the form of a throat provided between structures 1 and 3, for entry of the marginal portion of a body 15 of which the lateral position of an edge 16 is to be sensed and indicated by magnitude of the signal pressure in chamber 6 and transmission duct 11. The condition of the jet that is altered in correspondence to the lateral position of edge 16, and that affects volume flow rate of jet fluid reaching receiver port 4, is the cross sectional area of the jet that passes the edge 16. As the lateral position of

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edge 16 changes, the unintercepted portion of the jet, and the volume rate of flow of jet fluid reaching port 4 and flowing through passage 8 and chamber 6 will correspondingly change, and consequently signal pressure developed within chamber 6 and transmitted through duct 11 to assembly 12 will vary proportionably with distance of edge position change, increasing and decreasing respectively as edge 16 moves rightward and leftward as seen in the drawing.

From the foregoing, construction, arrangement and operational features of devices arranged in accordance with the invention, and possible changes in and modifications of the exemplary specific disclosure herein contained will be apparent, and accordingly it is to be understood that the limits of the invention are to be ascertained solely from the appended claims.

I claim:

1. In a receiver for a jet type body edge position detector having means for directing a fluid sensing jet through a region of location of a marginal body portion the lateral position of the edge of which is to be detected, for interception of a portion of said jet by the marginal portion of the body adjacent said edge, and said receiver comprising structure having a port for reception of the jet portion passing said edge and an internal pressure signal developing chamber communicating with said port, the improvement comprising an aspirator including means for forming fluid entering said port into a high velocity stream and direct the latter through and from said chamber in jet form, thereby to vary magnitude of pressure in said chamber as a function of volume rate of flow of fluid so received, and passage means communicating with said chamber for transmitting said pressure as a signal corresponding to the lateral position of a body edge located in said region.

2. The improvement of claim 1, wherein said chamber is provided with an exhaust opening, comprising an element of said aspirator and opening to atmosphere.

3. The improvement of claim 1, wherein said aspirator comprises structure enclosing a passage of which said port constitutes the inlet, said passage having a throat portion of cross section progressively decreasing toward said chamber and having a discharge orifice opening into said chamber for directing through the latter the fluid received by said port in the form of a stream, and structure provided with an exhaust opening that is spaced from said orifice across at least a portion of said chamber and that is registered with said orifice.

4. The improvement of claim 1, wherein said passage is straight, and said aspirator comprises structure provided with an exhaust opening aligned with the axis of said passage.

5. The improvement of claim 1, wherein said structure provided with a passage includes a nipple portion projecting into said chamber.

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