137-13. OR 3,537,465 SR

[11] **3,537,465**

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[21] Appl. No. **624,294**
[22] Filed **March 20, 1967**
[45] Patented **Nov. 3, 1970**

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[54] FLUID CONTROL APPARATUS

32 Claims, 17 Drawing Figs.

[52] **U.S. Cl.** **137/81.5**
[51] **Int. Cl.** **F15c 1/20**
[50] **Field of Search** 137/81.5

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Primary Examiner—Samuel Scott
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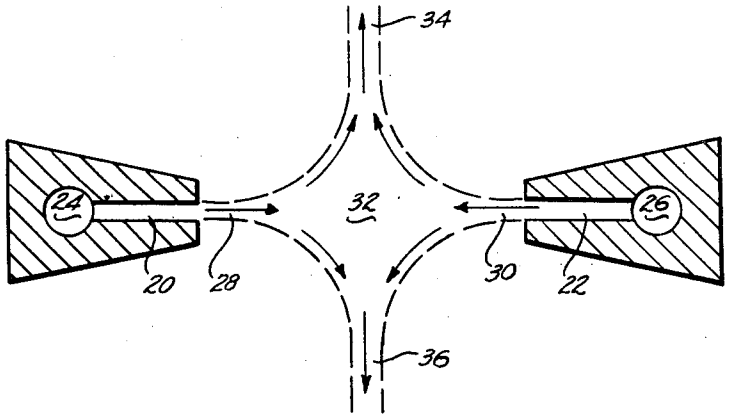
ABSTRACT: Apparatus for amplifying fluid signals embodying two opposed submerged impacting power jets capable of controlled relative displacement so that at impact they may be coaxial or noncoaxial. Said jets are constant but need not be of equal strength. The direction of secondary or impact jets emanating from the impact region is determined by off-set alignment of one or both of the power jets which may be produced by relative displacement, by a rotating shaft in the impact region, a vortex flow, or transverse control jets, or by any other suitable means.

Trans 137/13

X2356

X2364

X2326



X2458

X2521

X2465

FIG. 1

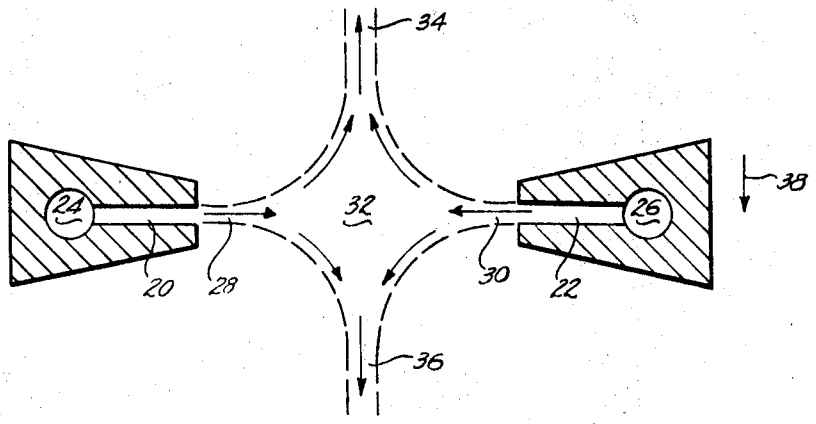


FIG. 2

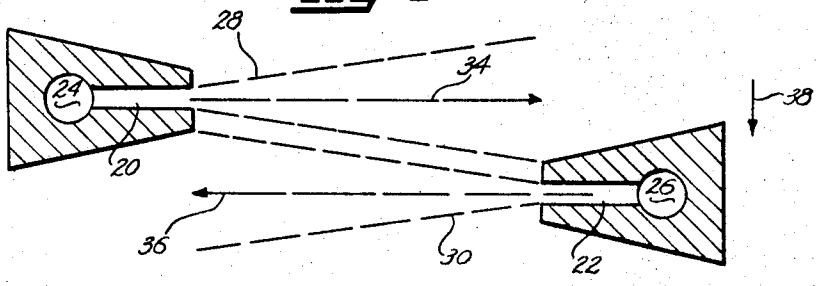
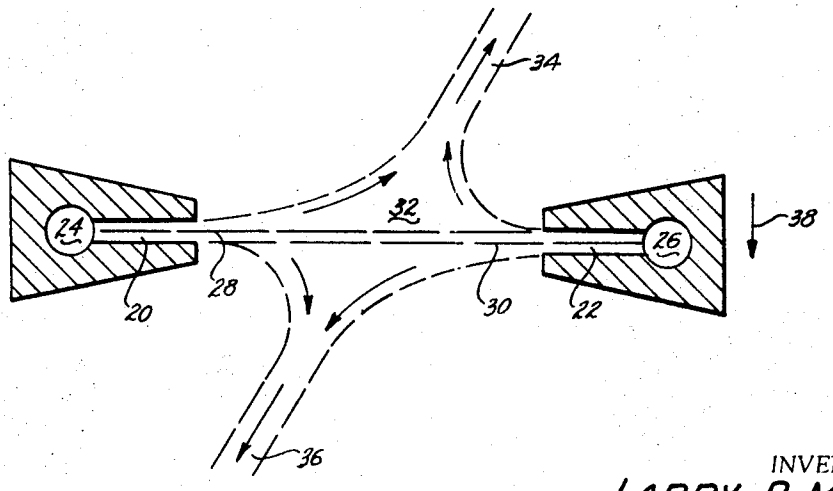


FIG. 3



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FIG. 4

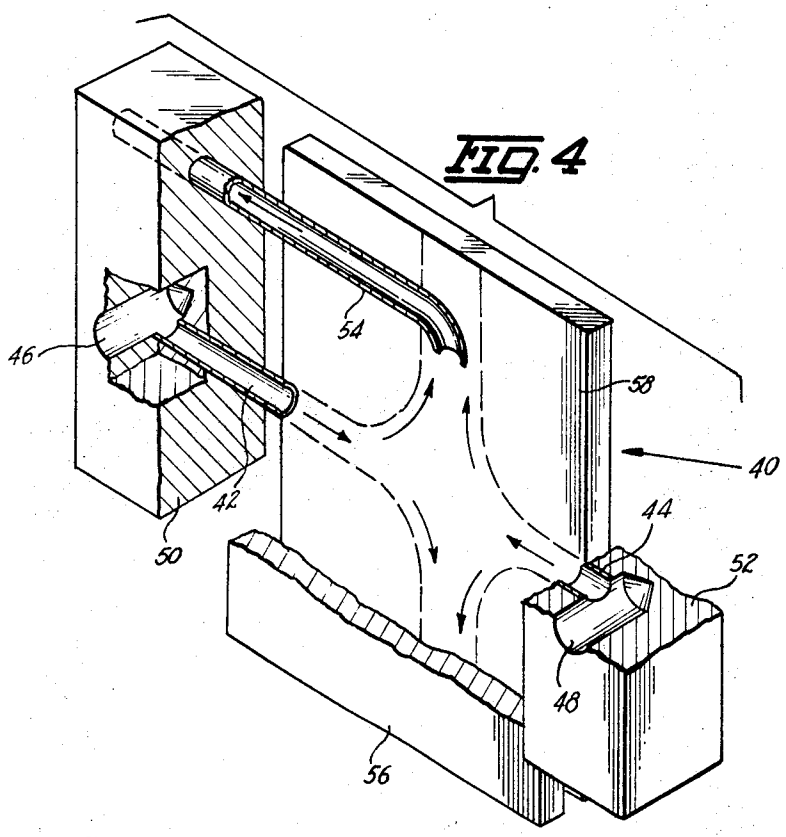


FIG. 5

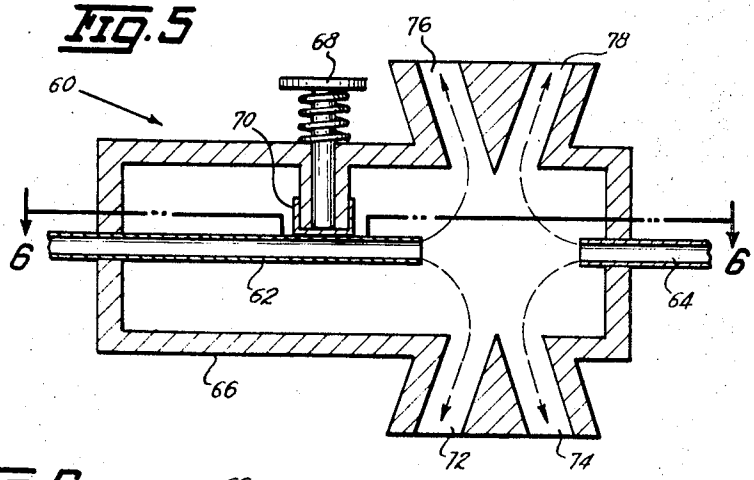
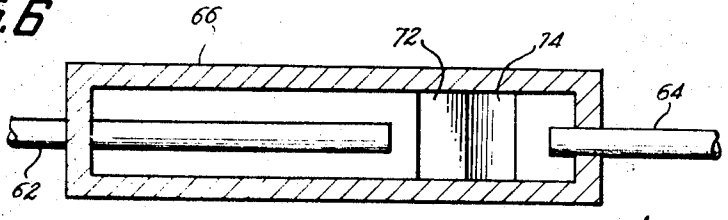


FIG. 6



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FIG. 7

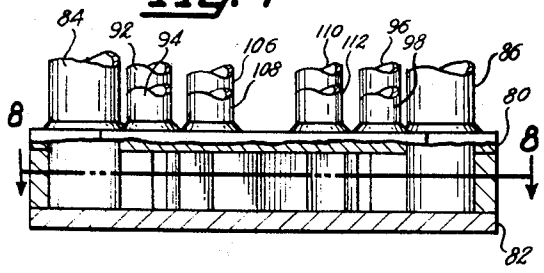


FIG. 8

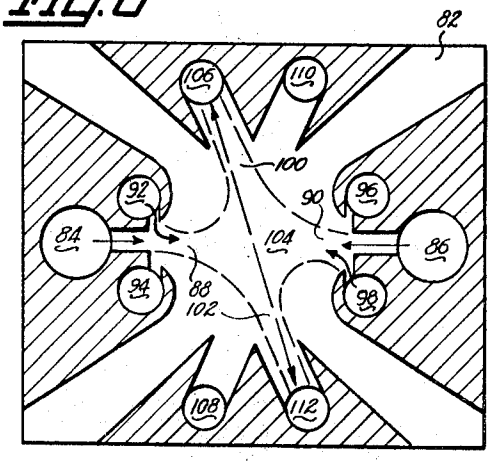


FIG. 9

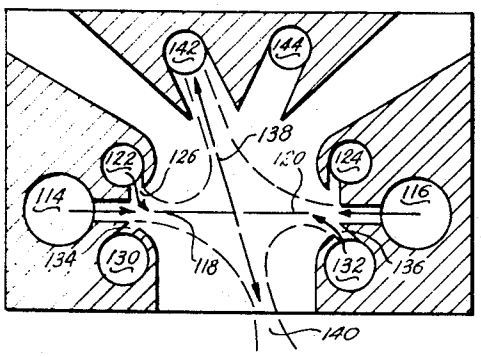


FIG. 10

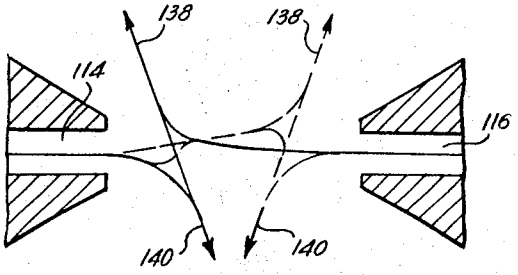


FIG. 11

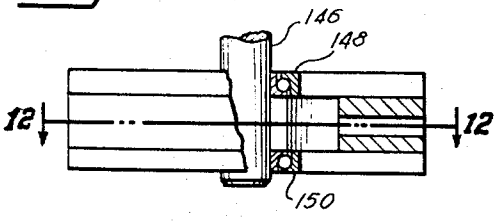


FIG. 13

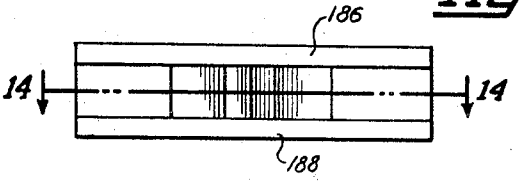


FIG. 12

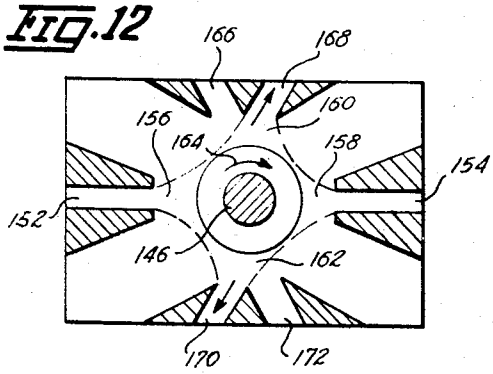
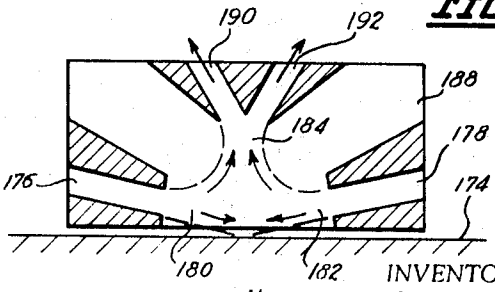


FIG. 14



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FIG. 15

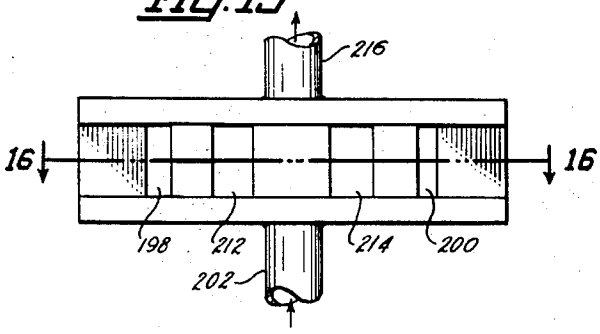


FIG. 16

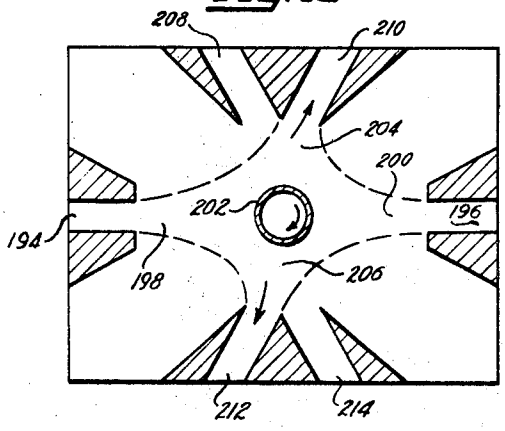
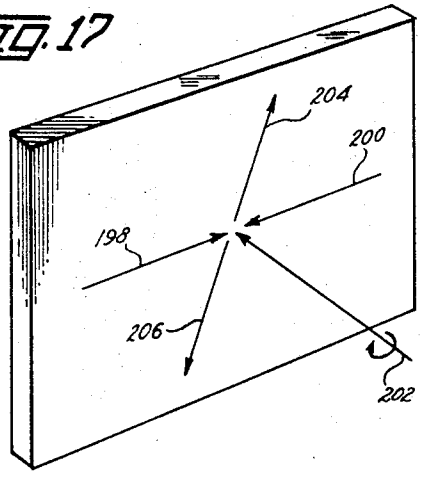


FIG. 17



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FLUID CONTROL APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to apparatus for amplifying fluid signals and is more particularly concerned with what is known as pure fluid amplifiers.

One of the important novel concepts of this control system is the production of secondary signal designating jets from a controlled position established by opposed, constant but not necessarily equal, impacting power jets wherein the relative position of the jets at the point of impact can be selectively varied from coaxial to noncoaxial in what I have designated as the partial impact modulator.

The partial impact concept may be utilized in a variety of ways for producing and amplifying a fluid signal and several modes of operation will be described herein that will include a fluid amplifier, a position transducer, a manual input fluid keyboard, an angular velocity transducer, a linear velocity transducer and a vortex sensor.

2. Description of the Prior Art

While fluid control systems utilizing one or more forms of mechanical components to control the fluid stream have been in use for some time, the technology of pure fluid amplifiers wherein a fluid is the control means for the fluid stream has been developing only relatively recently. Prior art devices based upon these concepts include the vortex amplifier, boundary layer amplifier, jet-interaction amplifier, and turbulence amplifier. Such devices utilize some form of stream interaction whereby a small control jet is used to control a larger power jet and are generally reviewed and discussed in Machine Design, June 24, 1965. A recent development, termed the impact modulator, where opposed power jets coaxially impact to provide signal producing jets is disclosed in U.S. Pat. No. 3,272,215, Sept. 13, 1966. Illustrative of the keyboard mode of amplifying signals are the U.S. Pat. Nos. 3,055,533, Oct. 24, 1961 and 3,034,628, May 15, 1962.

These prior art devices have both advantages and disadvantages as for example the impact modulator of U.S. Pat. No. 3,272,215 exhibits a high gain and a high signal-to-noise ratio but the gain falls off rapidly at higher frequencies. In velocity sensors, there appears the disadvantage of being unable to distinguish direction of rotation without special phase discriminating circuits. Stream interaction devices generally have limited signal gain and, thus, the present invention contemplates a control system in which many of the advantages developed in prior systems can be incorporated to the exclusion of the disadvantages.

The keyboard device as exemplified in U.S. Pat. No. 3,034,628 includes an open port in the key to be manually covered and uncovered and has the potential disadvantage of permitting foreign matter to enter the system and clog it. The piston-type keyboard (U.S. Pat. No. 3.055,533) requires sliding seals which are susceptible to leakage because of the pressures present in the system against which such seals must hold.

SUMMARY

The present invention is directed to the new concept of a partial impact modulator in a fluid control device, and is based upon the interaction between two opposed submerged power flows that are susceptible of controlled relative displacement so that they will impact either coaxially or noncoaxially and produce secondary impact jets which are collected in a predetermined manner for signal purposes. The power flows are constant but need not be equal and the impact region is stationary which distinguishes it from the impact modulator of U.S Pat. No. 3,272,215 where the strength of the opposed power jets is variable to cause a shifting of the point of impact and corresponding directional changes in the flow of the secondary jets.

The fluid which may be used in this control system can be a gas or liquid or any other substance which will flow where pressure gradients exist. The noncoaxial alignment of the power jets in the impact region may be accomplished in different ways and for different specific purposes and include generally a fluid control flow or relative displacement of the power nozzles which create the jet power stream.

Relative displacement of the power jets, if the same is not prefixed, may be accomplished, as will appear, by the stream interaction concept or by the boundary-layer method. Likewise, the Coanda effect can be utilized to produce a bistable device, if desired.

As one important mode of developing the partial impact modulator there is used a rotatable shaft intersecting the impact region whereby, as the shaft rotates intermediate the power nozzles, a viscous effect acts to deflect the power jets. Similar control of the power jets is accomplished by the vortex sensor where the frictional effect of a rotating flow through the impact region is utilized to produce a partial impact of the power jets and resulting directional changes in the secondary jets.

Another mode of utilizing the partial impact concept embraces a linear velocity transducer wherein the fluid signal produced is a function of the linear velocity of a surface, flat or curved, moving relative to the impact region of two opposed impacting power streams.

A further mode of producing fluid signals with the partial impact concept as contemplated herein is to provide relative displacement of one of the power jets by an improved manual keyboard acting upon a movable power nozzle means.

The objects of this invention together with the several modes of operation outlined and the advantages of the same will be more fully described and developed in relation to the more detailed description of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view illustrating the flow principles of the present invention;

FIG. 2 is a schematic view illustrating one of the extremes of a range of nozzle positions within the concept of the present disclosure;

FIG. 3 is a schematic view disclosing displacement of opposed nozzles for the partial impact modulator in accordance with the principles of the instant invention;

FIG. 4 is a perspective view partially cut away to disclose this invention as employed with a position transducer;

FIG. 5 is sectional view of a keyboard device according to the present invention;

FIG. 6 is a sectional view taken on the line 6–6 of FIG. 5;

FIG. 7 is a top plan view of a fluid amplifier according to the present invention;

FIG. 8 is a sectional view taken on the line 8–8 of FIG. 7;

FIG. 9 is a sectional view similar to FIG. 8 but modified to combine the concepts of the impact modulator, the partial impact modulator and jet-interaction;

FIG. 10 is a schematic view illustrating the variation in fluid flow relative to FIG. 9;

FIG. 11 is a sectional view of the upper part of an angular shaft velocity transducer according to the present invention;

FIG. 12 is a sectional view taken on the line 12–12 of FIG. 11;

FIG. 13 is a top view of a linear velocity transducer according to the present invention;

FIG. 14 is a sectional view taken on the line 14–14 of FIG. 13;

FIG. 15 is an elevational view of a vortex sensor according to the present invention;

FIG. 16 is a sectional view taken on the line 16–16 of FIG. 15; and

FIG. 17 is a schematic view of the flow pattern in FIGS. 15 and 16.

Referring first to FIGS. 1—3 of the drawings, there is illustrated the new flow concept which is the basis of the present invention and which I have termed the partial-impact modula-

tor. In each of these drawings, identical opposed supply nozzles 20 and 22 are supplied with a fluid by ports 24 and 26 at identical pressures to establish the respective power jets 28 and 30, which impact in the impact region 32 and produce the impact jets 34 and 36. When the momentum of the power jets 28 and 30 are identical, it will be seen that the impact region 32 is located midway between nozzles 20 and 22 and with such nozzles directly opposed as seen in FIG. 1, the impact jets 34 and 36 will be perpendicular to the power jets 28 and 30. FIG. 2 shows nozzle 22 displaced in the direction of arrow 38 to a position where no interaction occurs between power jets 28 and 30 so that the impact region 32 becomes nonexistent and the impact jets 34 and 36 become in effect the power jets 28 and 30, respectively. It will also be understood that nozzle 22, for example, may be moved in a direction opposite to arrow 38 so that impact jets 34 and 36 become the power jets 30 and 28 respectively. FIG. 2 thus illustrates one of the extremes of a range of positions of nozzle 22 over which the impact jets 34 and 36 assume all directions over a 180° arc and FIG. 1 shows the intermediate directions of the impact jets 34 and 36 in the 180° range. FIG. 3 shows a small relative displacement of nozzles 20 and 22 so that a partial impact of power jets 28 and 30 results.

The exact directions of impact jets 34 and 36 is a nonlinear function of the relative misalignment of nozzles 20 and 22. The fluid referred to throughout this disclosure can be a gas or liquid or any other substance which will flow where pressure gradients exist. Also, the flow patterns are quite general and devices using this concept may use plates on one or both sides of the nozzles 20 and 22 to confine the flow to essentially two directions which would then be the plane of the FIGS. 1—3.

In FIG. 4 there is shown a position transducer designated generally by the numeral 40 to illustrate one application of the present invention. The primary object of this device 40 is to produce a fluid signal when two objects reach a predetermined position relative to one another. The transducer 40 consists of two supply nozzles 42 and 44 supplied with a fluid by ports 46 and 48 and as shown in FIG. 4, supply nozzles 42 and 44 are identical as are the fluid pressures in ports 46 and 48 although identical nozzles and fluid pressures are not a prerequisite to the operation of the transducer. Supply nozzles 42 and 44 may be formed as an integral part of or attached to a machine elements 50 and 52 which experience a relative motion. A collector duct 54 is positioned at a radial distance and angular position from the impact region which provide optimum performance of the device and it will be understood that a plurality of collector ducts can also be used, if desired. Plates 56 and 58 serve to confine the flow so that a maximum signal is obtained when it impinges on the inlet of collector duct 54. A common device presently employed for position sensing is a supply jet and collector tube which receives a signal when alignment of the two is achieved and an output occurs if there exists any overlap of the nozzle and collector. In the transducer 40, however, a signal is produced only upon close alignment of nozzles 42 and 44 if the geometric parameters are properly chosen.

With reference now to FIGS. 5 and 6, I show this invention applied to a manual-input fluid keyboard 60 which is used to allow the entering of data into a fluid system. The fluid keyboard per se is not new and may take one of several well-known forms. As seen in FIG. 5, it comprises two opposed nozzles 62 and 64 mounted within a housing 66. Nozzle 62 is preferably a semirigid tube which maintains the position shown unless forced downward by button 68. However, nozzle 62 may also be a pivoted tube with an elastic restoring device or any other suitable means which would allow a relative motion between nozzles 62 and 64 and return it to a definite equalibrium position upon the removal of an actuating force. A flexible diaphragm 70 is preferably used to prevent the loss of fluid although any conventional sealing device may be employed.

In this regard, diaphragm 70 is preferable to a conventional seal because of the short travel of key 68 and because the seal at 70 need be effective only against a pressure much lower than the output signal pressure since such output signal pressure is derived primarily from the dynamic head of the jet flow. A slight depression of the button 68 changes the position of nozzles 62 and thus changes the direction of the flow of fluid. Suitable collector ports 72, 74, 76 and 78 are positioned to detect the flow changes and it will be appreciated that a number of collector port variations are possible. Flow attachment walls may be used to produce a bistable output and nozzle 64 can be made similar to nozzle 62. A downward deflection of nozzle 64 would reset the output or provide a second output signal. From the foregoing illustration it will be appreciated that many other possibilities for obtaining a desired keyboard function will present themselves to those familiar with the art and many other similar devices can be arranged to produce the desired keyboard array.

A fluid amplifier employing the partial-impact concept is illustrated in FIGS. 7 and 8. As shown, the flow of fluid is confined by plates 80 and 82 so that it is essentially two-dimensional although the flow could be allowed to be three-dimensional if desired. Supply nozzles 84 and 86 supply identical opposed power jets 88 and 90 which interact at an intermediate position. Control nozzles 92 and 94 are positioned to allow a controlled deflection of power jets 88 while control nozzles 96 and 98 are positioned to control the deflection of power jet 90. Control nozzles 92 and 98 are supplied with fluid from a common signal source as are control nozzles 94 and 96 so that power jets 88 and 90 are always deflected equally in opposite directions. Power jets 88 and 90 are always parallel and it is apparent that with appropriate geometric parameters a small deflection of power jets 88 and 90 will create a sizable misalignment of power jets 88 and 90 which causes a large change in the direction of impact jets 100 and 102. Thus, since the momentums of power jets 88 and 90 remain equal at all times, the impact region 104 does not move in the direction of power jets 88 and 90 as is true with the impact modulator. Collector ducts 106, 108, 110 and 112 are positioned to collect the flow of the impact jets 100 and 102 and produce an output flow and/or pressure change as the power jets 88 and 90 are deflected. Thus, the method used to deflect power jets 88 and 90 need not be restricted to the jet interaction concept and the boundary-layer concept is an example of another suitable method of deflecting the power jets 88 and 90. The Coanda effect may be utilized to produce a bistable device by including appropriate flow-attachment walls to maintain the flow of impact jets 100 and 102 into collector ducts. An initial offset between supply nozzles 84 and 86 may be used to bias the amplifier to a desired quiescent operating point. The power jets 88 and 90 can be unequal to place the impact region 104 nearer supply nozzle 84 or 86 if desired. If this is done and with the power jets 88 and 90 deflected independently, the direction of impact jets 100 and 102 will have a greater sensitivity to the deflection of the longer power jet 88 or 90 as the case may be. The concept of the impact modulator may be incorporated into the design to both position the impact region and the direction of impact jets 100 and 102 and produce some unusual logic functions. The number of collector ducts may, of course, be varied as desired and it will be appreciated that a great number of variations of this fluid amplifier are possible by combining various of the features mentioned. A further example of a fluid amplifier is shown in FIG. 9 which combines the partial impact concept, the impact modulator concept and the jet-interaction concept. Two supply nozzles 114 and 116 are directly opposed and supply similar power jets 118 and 120. Control nozzles 122 and 124 supply control jets 126 and 128 perpendicular to power jets 118 and 120. Control nozzles 130 and 132 are larger than control nozzles 122 and 124 and supply control jets 134 and 136 which are not perpendicular to power jets 118 and 120. The geometric parameters are such that for given control pressures, all of the control jets 130, 132, 134 and 136 have equal components of momentum perpendicular to the axis of the supply nozzles 114 and 116. A similar pressure signal at control nozzles 122 and

132 will cause equal and opposite deflections of power jets 118 and 120. However, since control jet 136 has a component in the direction of power jet 120, the impact region will move towards supply nozzle 114 simultaneous to the change in direction of the impact jets 138 and 140. FIG. 10 illustrates schematically how the fluid flow would vary and indicates why only two collector ducts 142 and 144 are shown. A collector duct may also be included to utilize the kinetic energy of impact jet 140 for any other suitable purposes.

Reference is now made to the angular velocity transducer in FIGS. 11 and 12 which is an application of this invention to create a fluid signal that is a function of the angular velocity of a rotating shaft. Shaft 146 is mounted on bearings 148 and 150 and is driven at the same speed as the rotating machine element (not shown) whose angular velocity is of interest. Shaft 146 may be mounted in many ways including a simple extension of the rotating machine element. Such shaft 146 is located midway between coaxial supply nozzles 152 and 154 which supply equal and opposite power jets 156 and 158. The flow is essentially the same as that shown in FIG. 1 and impact jets 160 and 162 emanate from the impact region about shaft 146 at right angles to power jets 156 and 158 when the shaft is stationary. When shaft 146 is rotating, as represented by arrow 164 viscous effects cause the direction of impact jets 160 and 162 to change. If the diameter of shaft 146 is increased, the direction of impact jets 160 and 162 becomes more sensitive to the rotation of shaft 146. Collector ports 166, 168, 170 and 172 collect the flow to give an output fluid signal. Again, many collector port configurations are possible.

In FIG. 13 there is shown a linear velocity transducer having the purpose of producing a fluid signal which is a function of the linear velocity of a surface moving relative to it. This device is essentially an extreme variation on the angular velocity transducer where the shaft is very large as compared to the size and separation of the power nozzles. The surface 174 need not be flat but can be the surface of a rotating cylinder or disk. Nozzles 176 and 178 supply equal and opposite power jets 180 and 182 which, when the device is stationary relative to the surface 174, interact and form a single impact jet 184 midway between nozzles 176 and 178. Plates 186 and 188 are maintained as close to surface 174 as practical to minimize fluid losses and sealing methods could be applied to further minimize losses. Collector ducts 190 and 192 are located to produce an output fluid signal depending upon the position of impact jet 184. If the surface 174 has a relative motion as shown in FIG. 12, viscous effects cause an increase in momentum of one power jet and a decrease in the other so that the impact jet 184 changes position and causes a change in the output signal.

Another mode of use of the present invention is the vortex sensor shown in FIGS. 15 and 16 and which is designed to sense a rotating flow of fluid in a cylinder. Opposed supply nozzles 194 and 196 supply equal and opposite power jets 198 and 200 which impact at the position of cylinder 202. Assuming negligible fluid frictional losses, the pressure in the region of cylinder 202 is that of the fluid supplied to the supply nozzles 194 and 196. The cylinder 202 must be maintained at the pressure of the impact region and the impact jets 204 and 206 will form as shown and will be collected by collector ducts 208, 210, 212 and 214. A constant axial flow in cylinder 202, through the impact region and out cylinder 216 will alter the flow in the impact region but the impact jets 204 and 206 must still form as shown. However, if the flow in the cylinders 202 and 216 is rotating, frictional effect change the direction of impact jets 204 and 206 resulting in a change in the output fluid flow. Better utilization of axial flow in cylinder 202 can be achieved by removal of the cylinder 216 as shown schematically in FIG. 17. An advantage of this arrangement is that the axial flow from cylinder 202 and the power jets 198 and 200 have total momentums such that all three flows impact at a common point. The resulting impact jets 204 and 206 then include the mass flows of all three sources.

It will be understood from the foregoing that the precise location of the impact region will depend upon the total momentum fluxes of the two power jet streams and the effective strength of said streams is a function of pressure and the size of the nozzles. Thus, the nozzles creating the power jet streams may be of like or different sizes and subjected to like or different pressures. The source of such pressure may be by any suitable means such as a mechanical pump, compressed gas or any other device having the purpose of maintaining a pressure gradient in the system. In addition, it is pointed out that the power jets may be issued either into a region substantially at atmospheric pressure or into a region that is sealed against environmental pressures.

It will be understood that the phraseology employed herein is for the purpose of description and not for limitation and that various modes of carrying out the invention disclosed may be made within the scope of what is claimed without departing from the spirit and purpose thereof. It is thus intended to cover by the claims any modifications and variations which may be reasonably included within their scope.

I claim:

1. A fluid apparatus, comprising:
- means for establishing substantially opposed fluid power jet streams of respective constant velocities, disposed to impact at an impact location and in a predetermined alignment;
- means to effect displacement of at least one of said power jet streams relative to the other so that said impact location is maintained substantially stationary and the alignment of said power jet streams is selectively alterable from said predetermined alignment;
- the impact of said power jet streams producing at least one secondary jet stream emanating from said impact location at an angle which is a function of the alignment of said power jet streams; and
- means to collect said secondary jet stream to establish an output flow.

2. The fluid device of claim 1 wherein said power jet streams are selectively issued under substantially like and different but respective constant pressures.

3. The fluid device of claim 1 wherein the means for effecting relative displacement of said power jet streams comprises:
- means establishing first and second control jet streams to act against said respective power jet streams on first corresponding sides thereof to deflect the same;
- means establishing third and fourth control jet streams to act against said respective power jet streams on second corresponding sides thereof to deflect the same;
- said first and third control jet streams being disposed on opposite sides on one of said power jet streams and said second and fourth control jet streams being similarly disposed relative to said other power jet stream; and
- a respective common source of fluid pressure for said respective first and second control jet streams and said third and fourth control jet streams whereby said power jet streams are deflected equally in opposite direction to establish the direction of said secondary jet stream.

4. The fluid device of claim 1 wherein the means for effecting relative displacement of said power jet streams comprises:
- movable nozzle means for establishing the direction of flow of one of said power jet streams and adapted to normally maintain said flow in said predetermined alignment with said other power jet stream; and
- manually movable key member for acting against said movable nozzle means so as to effect displacement of the power jet stream emanating therefrom relative to said other power jet stream so as to establish the direction of said secondary jet stream.

5. The fluid device of claim 1 wherein said means for establishing includes:
- respective opposed nozzles adapted to be connected to a source of fluid pressure; and
- said nozzles being of different sizes but subjected to equal pressures.

6. The fluid device of claim 1 including respective opposed nozzles adapted to receive pressurized fluid, said nozzles being of different sizes and subjected to different pressures.

7. The fluid device of claim 1 wherein the predetermined alignment of said power jet streams is coaxial.

8. The fluid device of claim 1 wherein the means to collect said secondary jet stream is arranged to provide element symmetry.

9. The fluid device of claim 1 wherein the geometrical positions of the means to collect said secondary jet stream provides more than one output signal each having a different functional relationship to the displacement of said power jet streams.

10. The fluid device of claim 1 wherein said means to collect said secondary jet stream is adapted for displacement so that the functional relationship between said output flow and said power jet stream displacement is varied by the displacement of said means to collect said secondary jet stream.

11. The fluid device of claim 1 wherein said power jet streams are issued into a region at substantially atmospheric pressure.

12. The fluid device of claim 1 wherein said power jet streams are issued into a region sealed against environmental pressures.

13. The fluid device of claim 1 including plates to constrain the flow of said streams to two dimensions.

14. The fluid device of claim 1 wherein the means for effecting relative displacement of said power jet streams comprises a shaft adapted for rotation and disposed to intersect the path of said power jet stream at said impact location whereby as said shaft rotates, viscous effects act to establish the direction of said secondary jet stream.

15. The fluid device of claim 14 wherein the sensitivity of the direction of flow of said secondary jet stream increases with increase in diameter of said shaft.

16. The fluid device of claim 1 wherein the means for effecting relative displacement of said power jet streams comprises a fluid flow adapted to be axially rotated and disposed to intersect the path of flow of said power jet streams at said impact location whereby the frictional effect of the impact of said fluid flow with said power jet streams acts to establish the direction of said secondary jet stream.

17. The fluid device of claim 16 wherein said rotating fluid flow is constant.

18. The fluid device of claim 16 which includes:

first and second opposed, spaced and axially aligned cylinders having an axis disposed to intersect the path of flow of said power jet streams;

a fluid flow adapted to be axially rotated and introduced into said first cylinder to pass through said impact location and out of said second cylinder;

said fluid flow impacting with said power jet streams at said impact location; and

said secondary jet stream including the mass flows of said power jet streams.

19. The fluid device of claim 16 which includes:

a cylinder having an axis disposed to intersect the path of flow of said power jet streams;

a fluid flow adapted to be axially rotated and introduced into said cylinder to pass through said impact location;

said fluid flow impacting with said power jet streams at said impact location; and

said secondary jet stream including the mass flows of all three of said streams.

20. A fluid control apparatus comprising:

a pair of spaced plates defining a fluid stream impact region therebetween;

a surface means adjacent said impact region and adapted for linear movement relative thereto;

means for establishing opposed and aligned power jet streams to impact at a location in said impact region and produce a single secondary jet stream emanating from said location and having a direction angularly from said surface means;

the precise direction of said secondary jet stream being a function of the linear velocity of said surface means; and

means to collect said secondary jet stream to establish an output flow.

21. The fluid device of claim 20 including means for sealing said impact region against fluid loss.

22. The fluid device of claim 20 wherein said surface means is flat.

23. The fluid device of claim 20 wherein said surface means is arcuate.

24. A fluidic element for providing a fluid output signal as a function of a variable input condition, said element comprising:

first and second nozzle means for issuing respective first and second power streams of fluid at constant pressure into intersection at a predetermined impact location, said power streams subtending an obtuse angle having a maximum of 180 degrees therebetween, fluid from said power streams forming a resultant stream emanating from said predetermined impact location in a direction determined by the relative momenta between said first and second power streams;

control means responsive to said input condition for effecting mutual displacement between said first and second power streams such that said power streams continue to intersect at said predetermined impact location, whereby the direction of said resultant stream is varied in response to said input condition; and

output means for receiving varying portions of said resultant stream as a function of its direction.

25. The element according to claim 24 wherein said control means comprises means for effecting relative displacement between said first and second nozzle means.

26. The element according to claim 24 wherein said control means comprises control nozzle means responsive to said input condition for issuing at least one control stream of fluid in deflecting relation with said first power stream.

27. The element according to claim 24 wherein said control means comprises movable means disposed at said predetermined impact location and movable in response to said input condition for deflecting first and second power streams.

28. A fluidic element for providing a fluid output signal as a function of a variable input condition, said element comprising:

means for issuing first and second power streams of fluid at respective constant pressures and intersecting at a predetermined location, said power streams having respective opposed flow components, fluid from said power streams forming a resultant stream emanating from said predetermined location in a direction determined by the relative strength of said opposed flow components;

means responsive to said input condition for effecting mutual displacement between said power streams without moving the intersection of said streams from said predetermined location, whereby said opposed flow components vary in strength in response to said input condition to in turn vary the direction of said resultant stream; and

means for collecting varying portions of said resultant stream as a function of its direction.

29. A method for providing a fluid signal as a function of a variable condition, said method comprising the steps of:

issuing a pair of substantially opposed power streams of fluid at respective constant pressures and impacting at a predetermined location to provide a resultant stream emanating from said predetermined location and having a direction determined by the momenta of said pair of power streams;

maintaining impact of said pair of power streams at said predetermined location while varying the relative positions of said pair of power streams to concomitantly vary the direction of said resultant stream; and

collecting portions of said resultant stream as a function of the direction of said resultant stream.

30. The method according to claim 29 wherein varying the relative positions of said pair of power streams is achieved by deflecting at least one of said power streams with a control stream of fluid having a pressure which is a function of said input condition.

31. The method according to claim 29 wherein varying the relative positions of said pair of power streams is achieved by issuing at least one of said power streams from a movable location.

32. The method according to claim 29 wherein varying the relative positions of said pair of power streams is achieved by means of a member disposed at said predetermined location and movable in response to said input condition for deflecting said pair of power streams.