

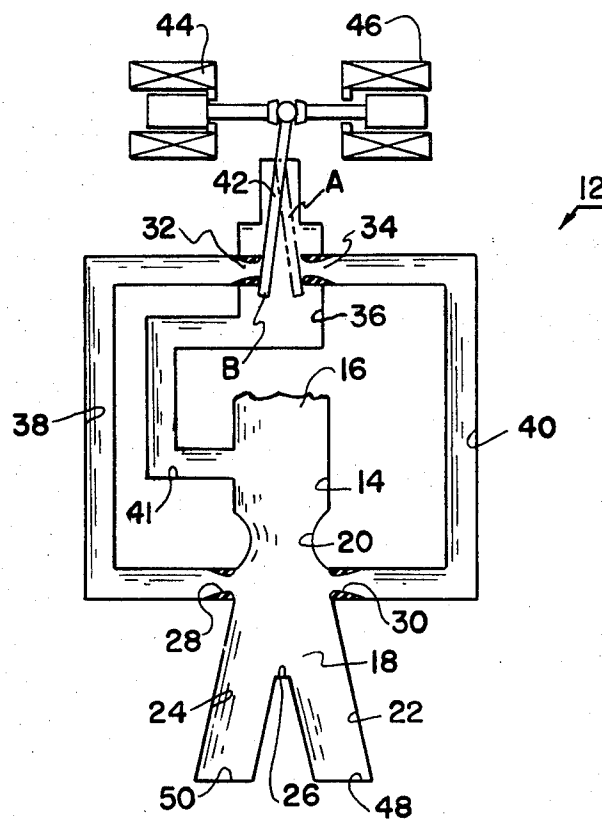
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FLUIDIC DEVICE

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FLUIDIC DEVICE

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2 Claims

ABSTRACT OF THE DISCLOSURE

A fluid amplifier having an interaction chamber therein and a plurality of fluid outputs extending therefrom and a plurality of control nozzles for directing fluid to said interaction chamber with means for selectively connecting the working pressure to one nozzle while restricting said pressure to the other nozzle for controlling the fluid output of the amplifier.

BACKGROUND OF THE INVENTION

This invention relates to power transmissions, particularly to those of the type comprising two or more fluid pressure energy translating devices, one of which may function as a fluid pump and another as a fluid motor.

This invention is generally concerned with pure fluid devices for controlling the direction of fluid in such transmission systems, and, in particular, to fluid amplifiers.

Fluid amplifiers are currently finding wide application in various fields due primarily to their reliability, temperature insensitivity, shock resistance, and ease of fabrication. These devices may be employed as digital or analog computing elements and also can be utilized as power devices to operate pistons and the like. Fluid amplifiers may be operated equally as well as pneumatic devices employing a compressible fluid, such as gas or air, or as hydraulic devices utilizing incompressible fluids, such as water or oil.

Fluidic amplifiers can be employed as power devices to drive comparatively large loads such as spool type valves and the like, which are operatively connected to the fluid receivers. In such power applications, it is very desirable that the load be operated in response to an application of a very low level input signal from an electronic or magnetic control system. It is further desirable in such devices that provision be made for supplying the fluid amplifier with fluid derived from the working fluid introduced into the load cylinder so that the fluid amplifier is self-energized.

Such a device includes a fluid amplifier section having a nozzle for generating a main jet of fluid, such as oil, the axis of the nozzle extending along a path midway between two fluid receiving load passages. The point of intersection of the nozzle and load passages is generally referred to as an interaction chamber. The jet of fluid is directed to one of the load passages by injecting a control jet into the interaction chamber from either of two control nozzles which are generally perpendicular to the main jet of fluid.

In the past, the control of the control jet has been accomplished in such devices by connecting each of the control jet nozzles to the working fluid supplied to the device and to a reservoir through a control passage. Control of the control jet is readily obtained by alternately opening and restricting communication between the control passage and the reservoir. When communication to the reservoir is restricted, the working fluid is directed to the control nozzle and into the interaction chamber to control the direction of the main jet of fluid. If the communication between the reservoir and the control passage is open, working fluid will be directed to the reservoir and thus the direction of the main jet is not effected. Such restric-

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tion and opening of the control passage may be obtained by using an electrically actuated servo leaf type flapper.

Such systems require a high level of input signal to the electrically actuating means since the flapper must act against the force created by the pressure of the working fluid in order to create the necessary restriction. Further, such forces tend to fatigue the flapper leading to a premature failure of the control device.

Further, since the control jet must be discharged into the reservoir when control of the main jet of fluid is not required, the total system leakage is unnecessarily increased.

SUMMARY OF THE INVENTION

This invention comprises a combination of a fluid amplifier and an electrically actuated flapper element in which a portion of the working fluid is directed to the interaction of the fluid amplifier by selectively connecting one of a plurality of control nozzles to the working fluid while restricting said working fluid from the other control nozzle by means of the flapper element.

It is therefore an object of this invention to provide a novel and improved input means for controlling the position of a fluid jet in a fluid amplifier.

It is another object of this invention to provide a novel and improved input means for controlling the position of a fluid jet in a fluid amplifier in which all control flow is collected and utilized for the output.

It is also an object of this invention to provide a novel and improved input means for controlling the position of a fluid jet in a fluid amplifier which is electrically actuated and has a minimum electrical power consumption.

It is a further object of this invention to provide a novel and improved input means for controlling the position of a fluid jet in a fluid amplifier which is compact and economical to manufacture and which is efficient and reliable in operation and has a long life.

Further objects and advantages of the present invention will be apparent from the following description, reference being made to the accompanying drawing wherein a preferred form of the present invention is clearly shown.

In the drawing, the single figure is a diagrammatic view of a fluid amplifier incorporating a preferred form of the present invention.

Referring now to the drawing, there is illustrated a pure fluid device 12 having a power stream input channel 14 connecting an inlet chamber 16 to an interaction chamber 18 by means of sonic venturi 20 which defines a fluid power stream emanating from venturi 20 into the interaction chamber 18. The other extremity of the inlet chamber 16 is connected to a pressure fluid source such as pressure energy translating device, not shown. First and second diverging output channels 22 and 24 also communicate with the interaction chamber 18 and define first and second output paths of fluid flow respectively. The output channels 22 and 24 diverge from a common wedge 26 disposed therebetween which is preferably truncated and forms one wall of the interaction chamber 18. The other walls of the interaction chamber 18 may be formed by extensions of the exterior walls of the output channels 22 and 24. The device 12 has a left control jet nozzle 28 and a right control jet nozzle 30 which communicate with the interaction chamber 18 at one extremity, and are connected respectively to left and right feedback control ports 32 and 34 in a servo valve chamber 36 by means of conduits 38 and 40, respectively.

The servo valve chamber 36 is connected to the inlet chamber 16 by means of conduit 41, thus, both chambers are substantially at the same pressure.

The pressure fluid in chamber 36 may be selectively

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directed to either left and right feedback control ports 32 and 34 by means of a leaf type flapper 42 which is mechanically linked and actuated by solenoids 44 and 46. When the solenoids are actuated so as to shift the flapper 42 rightwardly, as illustrated by the letter A, the pressure fluid entering the right feedback control port 34 is substantially restricted, thus, pressure fluid in chamber 36 will exit through the left feedback control port 32 and be directed to the interaction chamber 18 via conduit 38 and left nozzle 28. When the solenoids are actuated so as to shift the flapper 42 leftwardly, as illustrated by the letter B, the pressure fluid entering the left feedback control port 32 is substantially restricted, thus, pressure fluid in the chamber 36 will exit through the right feedback control port 34 and be directed to the interaction chamber 18 via conduit 40 and right jet nozzle 30.

Pure fluid device 12 may be constructed according to any of the methods known to those skilled in the art. The device 12 may be of the momentum exchange type wherein the power stream is deflected by one of the control jet nozzles which directs pressure fluid laterally at the stream.

This device is accordingly referred to as a proportional, or analog, device. A second type of device which may be used is generally known as a boundary layer, or Coanda effect, device. In this latter device, the power jet is deflected by the action of side walls of an interaction chamber which are shaped in such a way that the power stream will attach to one or the other of the walls of the output channels, but not both of the walls. This type of a device is basically a two position device, and for this reason, is referred to as a digital device. Either the analog or the digital type of device can be employed in combination with the subject invention.

When pressure fluid is directed through the left control jet nozzle 28 into the interaction chamber 18, the power stream will be directed through the flow path defined by channel 22, and when pressure fluid is directed through the right control nozzle 30 into the interaction chamber 18, the power stream will be directed through the flow path defined by the channel 24. Thus, the power stream may be selectively directed to either output channel 22 or 24 by means of positioning flapper 42.

Associated with the output channels 22 and 24 are fluid outlets 48 and 50, respectively.

If the flapper 42 is actuated so as to cause the power stream to be directed into the flow path associated with output channel 22 in a manner herebefore described, the power stream will exit through the fluid outlet 48 and may be directed to a pressure energy translating device, not shown, for use by the same.

When the flapper 42 is actuated so as to cause the power stream to be directed into the flow path associated with the output channel 24 in a manner herebefore described, the power stream will exit through the fluid outlet 50 and be directed to the said pressure energy translating device for use by the same.

It should be noted that that portion of the working fluid which flows from the inlet to either the feedback ports is collected in the interaction chamber and is utilized in the output of the device, thus, there is no leakage due to the present pilot control. Further, the flapper 42 in restricting the flow to a feedback port does not act against a large force as in the hereinbefore described devices used in the past, thus, the flapper is not highly stressed nor subject to fatigue and is therefore assured a

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long life. Since the flapper does not have to overcome a force of great magnitude, as in past devices, the level of input power to the solenoids will be substantially decreased relative to the aforementioned past devices.

It can thus be seen that the present invention provides an electrically actuated fluidic device capable of directing fluid selectively to a plurality of outlets, which has a minimum of electrical power consumption, in which its construction provides for the collection and utilization of the control working fluid and which is efficient and reliable in operation and has a long life.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A fluid amplifier device comprising:

- (a) a pure fluid element having an inlet connected to a power stream input channel for defining a power stream, first and second output channels each defining a path of fluid flow, and an interaction chamber disposed between and communicating with said channels;
- (b) means forming first and second jet nozzles associated with said interaction chamber, one of said jet nozzles being adapted to direct pressure fluid into said interaction chamber for directing said power stream to said first output channel flow path, the other being adapted to direct pressure fluid into said interaction chamber for directing said power stream to said second output channel flow path;
- (c) a fluid chamber having diametrically opposed fluid ports, one of which is connected to said first jet nozzle, the other being connected to the said second jet nozzle;
- (d) means connecting said inlet to said chamber for providing pressure fluid from said inlet to said jet nozzle via said fluid ports;
- (e) a flapper element for selectively restricting fluid communication between said connecting means and one of said opposed fluid ports while permitting fluid communication between said connecting means and the other of said fluid ports whereby said pressure fluid is directed to said interaction chamber and utilized in the output of the device; and,
- (f) means for actuating said flapper element from one opposed fluid port to the other opposed fluid port.

2. The combination as in claim 1, wherein said actuating means comprises:

- (a) a pair of electrically operated elements mechanically linked to said flapper and adapted to shift said flapper between said opposed fluid ports to selectively restrict the pressure fluid flowing there-through.

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