Oct. 24, 1961 W. G. WADEY 3,005,533

FLUID KEYBOARD USING JET-PIPE VALVES

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FIG. 1

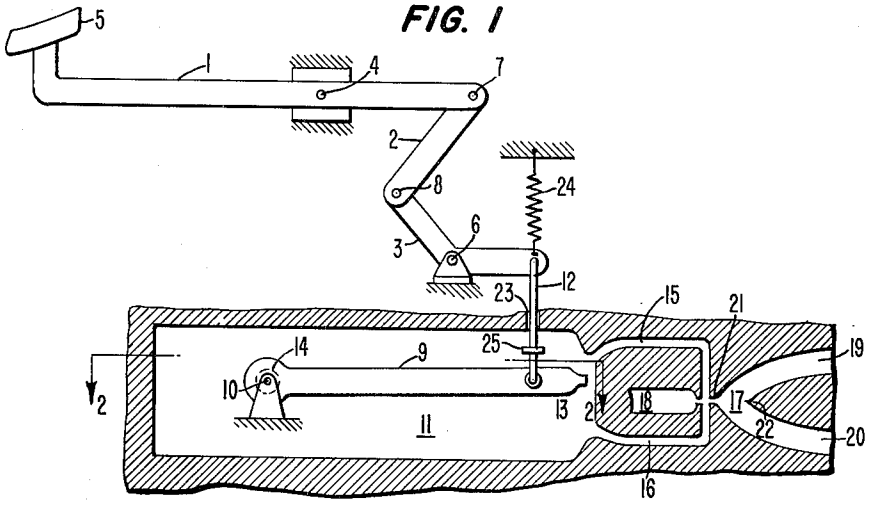


FIG. 2

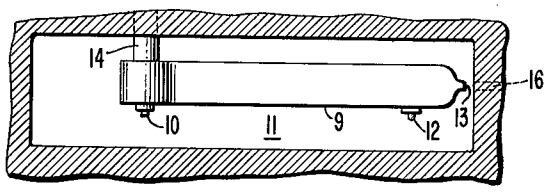
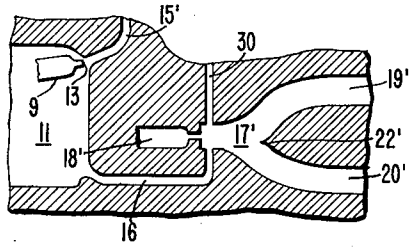


FIG. 3



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FLUID KEYBOARD USING JET-PIPE VALVES

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12 Claims. (Cl. 197—15)

This invention relates to fluid operated mechanical keyboards of the type used in adding machines, typewriters, and other similar devices. More particularly, the present invention relates to mechanically actuated keyboard devices of the type which produce fluid output signals when an operator depresses a key.

Fluid operated keyboards are well known in the art. One keyboard of this type is disclosed in my copending application Serial No. 66,062, filed Oct. 31, 1960, and entitled, Pneumatic Keyboard. However, the keyboard disclosed therein is limited to the use of a gaseous fluid as the working medium.

The recent application of fluid amplifiers to the field of data processing has led to the development of data handling systems which operate primarily on fluid principles. That is, the logical functions of the data processors are carried out by switching fluid streams in a predetermined fashion. These systems may use either a gas or a liquid as the working medium. While the device described in my aforementioned application is admirably suited for introducing information into a data processor in the form of pneumatic signals, it cannot be used with a processor operating with a liquid working medium.

Accordingly, the primary object of this invention is to provide a keyboard mechanism which may utilize either a gas or a liquid as the working medium.

An object of this invention is to provide a keyboard device which operates in response to depression of a key to produce a fluid output signal, the system being closed to prevent leakage of the fluid into the surrounding atmosphere.

Another object of the invention is to provide means responsive to the operation of a typical keyboard linkage for producing fluid output signals.

A further object of this invention is to provide mechanical means responsive to the depression of an actuating key for controlling the output of a fluid amplifier.

A still further object of this invention is to provide a key operated device which continues to produce an output signal indicating which key was depressed even after the key has returned to its inactive position.

The above stated objects are accomplished by providing jet-pipes which pivot about one end in response to the depression of keys. As the jet-pipes pivot, they selectively apply fluid pressure signals to the control signal inputs of fluid amplifiers.

Further objects of the invention and its mode of operation will become apparent upon consideration of the following description taken together with the accompanying drawing in which:

FIGURE 1 shows a first embodiment of the invention in which a push-pull amplifier is used;

FIGURE 2 is a view taken along the line 2—2 of FIGURE 1; and,

FIGURE 3 shows an alternative embodiment utilizing a bistable amplifier.

FIGURE 1 shows a typical keyboard linkage comprising key lever 1, arm 2, and angle lever 3. The key lever is mounted to pivot about the fixed pivot 4 as pressure is applied to the key 5. The angle lever is mounted so that it pivots about the fixed pivot 6. Free pivots 7 and 8 connect the arm 2 to the key lever and the angle lever.

The jet-pipe 9 is mounted on a pivot 10 and is enclosed in the fluid chamber 11. The whole fluid system is sealed so that either a liquid or a gas may be used as the working fluid. The arm 12 is connected at one end to the jet-pipe and at the other end to the angle lever, and passes into the chamber through a fluid seal 23.

The jet-pipe is a hollow structure having a small orifice 13 at one end. Fluid applied to the jet-pipe over duct 14 (see FIGURE 2) emerges from the orifice as a high velocity jet stream.

Two fluid passageways or ducts 15 and 16 are connected at one end to the fluid amplifier 17 and terminate at the other end as openings in the fluid chamber 11.

The fluid amplifier comprises a power stream input duct 18, a first output duct 19, and a second output duct 20. A fluid stream is applied to input duct 18 from a suitably regulated source such as a compressor or pump (not shown).

The ducts 15 and 16 serve as control signal input ducts for the amplifier. In the absence of control signals on these ducts, the power stream applied to duct 18 passes through the restricted opening 21 and emerages as a well defined jet stream which strikes the dividing wall 22 and splits into two substantially equal fluid streams which flow out through the output ducts 19 and 20.

If no pressure is applied to key 5, the tension spring 24 attached to the angle lever 3 will hold the mechanical linkage in a home position with the backstop 25 against the wall of the chamber thus limiting the upward movement of the arm 12. The backstop is adjusted so that in the rest position the jet stream emerging from orifice 13 is aimed at the opening into control signal input duct 15.

The fluid in duct 15 passes into the fluid amplifier and deflects the power jet issuing from opening 21 to the right. As a result, the fluid pressure in output duct 19 decreases and the fluid pressure in output duct 20 increases.

When the key 5 is depressed, the mechanical linkage pivots the jet-pipe clockwise about the pivot 10. At its lower limit of travel, the orifice 13 is directed at the opening into control signal input duct 16 and the jet stream issuing from the orifice passes over the duct 16 and into the amplifier where it strikes the power jet stream issuing from opening 21. This causes the power jet stream to be deflected to the output duct 19 and results in an increase in fluid pressure in this duct and a decrease in fluid pressure in duct 20. These changes in fluid pressure may be sensed to perform any desired work function such as actuating a print or punch member or storing information in a storage register.

When the operator releases the pressure on key 5, the mechanical linkage will be returned to its rest condition by the tension spring 24.

FIGURE 3 illustrates a second embodiment of the invention particularly suited for use in entering information into a register in the parallel mode. The jet-pipe and mechanical linkage may be the same as that shown in FIGURE 1. There are however, certain differences which enable the device to store an indication that the key associated therewith has been depressed.

The amplifier 17′ is a bistable fluid amplifier constructed in accordance with the techniques discussed in the publication Science and Mechanics, June 1960. The amplifier has a power stream input 18′, first and second output ducts 19′ and 20′, and first and second control signal input ducts 16 and 30. The control signal duct 16 terminates at its opposite end at an opening in the chamber 11. The signals applied to control signal duct 30 are for the purpose of resetting the amplifier and come from a source not shown.

The duct 15′ is not connected to the amplifier but in-

stead is connected to the low pressure side of the fluid source.

For an explanation of the theory of operation of a bistable fluid amplifier reference should be made to the aforementioned publication. In order to understand the operation of the present invention it is sufficient to say that the amplifier 17' has two stable states. That is, if a control signal directs the power stream to one of the output ducts 19' or 20', the power stream will continue to flow through this duct even after the control signal is removed.

If the power stream is flowing through output duct 19', a signal applied to control signal input duct 30 will cause the amplifier to switch to a second state with the power stream flowing through output duct 20'. The power stream will continue to flow through duct 20' until a control signal is applied to duct 16 at which time it will switch back to the output duct 19'.

Assuming that the reset state of the amplifier corresponds to the condition wherein the power stream flows through the duct 20', the device of FIGURE 3 operates as follows.

With the key 5 (FIG. 1) in its home position the jet stream issuing from orifice 13 is directed at the duct 15' and returns to the fluid supply source. When the operator depresses the key, the jet-pipe swings in a clockwise direction so that the jet issuing from the orifice passes into and through control signal duct 16 to the amplifier. This causes the power stream to switch so that it flows through output duct 19'. The pressure in duct 19' increases indicating that the key associated with it has been depressed. This pressure signal may be used to perform the desired work function.

Because of the bistable characteristics of amplifier 17' it will continue to produce an output signal on duct 19' after the operator has removed his finger and the key has been returned to its home position by the tension spring. This arrangement is preferable on an adding machine keyboard where one key in each of several columns is depressed after which an activate key is depressed to carry out the add operation.

Thus, if a plurality of columns of keys are provided, each controlling an amplifier in the manner shown in FIGURE 3, a selected key in each of the columns may be depressed and their corresponding amplifiers will still be producing signals after the last key is depressed. If the keyboard is provided with an add key, this key may open fluid gates so that all amplifier output signals may be entered into a storage register simultaneously. At the same time, the add key may produce a fluid signal which is applied to control signal input ducts 30 of the amplifiers to reset them. The keyboard is then ready to have another value entered by depressing the keys.

The above illustration shows one manner in which the embodiment of FIGURE 3 may be employed. If preferred, each amplifier may be reset immediately upon initiating a work function.

Other variations in the form and detail of the devices illustrated may be made by those skilled in the art without departing from the spirit of the invention. For example, a push-pull fluid amplifier having only one control signal input duct may be used in which case one of the ducts

15 or 16 would serve as a control signal input duct and the other duct would serve as a fluid return duct to the fluid supply source. It is intended therefore to be limited only by the scope of the appended claims.

I claim:

1. A keyboard device comprising: a fluid amplifier having at least two control signal inputs; movable jet producing means for selectively directing fluid to at least one of said control signal inputs; and a mechanical linkage for moving said jet producing means.

2. A keyboard device as claimed in claim 1 wherein said jet producing means is contained within an enclosure to prevent loss of fluid from the device.

3. A keyboard device as claimed in claim 2 wherein said jet producing means normally directs fluid to one of said control signal inputs; and means for actuating said mechanical linkage whereby said jet producing means directs fluid to another of said control signal inputs.

4. A keyboard device as claimed in claim 2 and further including a fluid duct and means for actuating said mechanical linkage, said jet producing means normally directing fluid to said fluid duct but directing fluid to one of said control signal inputs in response to actuation of said mechanical linkage.

5. The combination comprising: a fluid chamber having a jet-pipe therein; a fluid amplifier having two control signal ducts which terminate at openings in the wall of said chamber; and a keyboard linkage connected to said jet-pipe whereby said jet-pipe may be selectively positioned to direct its jet into said openings in response to actuation of said keyboard linkage.

6. The combination comprising: a fluid chamber, a fluid amplifier having at least one control signal input duct terminating at an opening in said chamber; a jet-pipe having an orifice in one end thereof; and key operated means connected to said jet-pipe for selectively positioning said orifice opposite said opening.

7. The combination as claimed in claim 6 and further including means for applying fluid to said jet-pipe and said amplifier.

8. The combination as claimed in claim 6 wherein said fluid amplifier is bistable and has two control signal input ducts; and means for applying reset signals to said second input duct.

9. The combination as claimed in claim 6 and further including a fluid duct terminating at an opening in said chamber; and means for positioning said orifice opposite the opening of said fluid duct when said key operated means is in an inoperative position.

10. The combination as claimed in claim 7 wherein said fluid is a liquid and means for preventing the escape of the liquid.

11. The combination as claimed in claim 6 wherein said fluid is a gaseous fluid.

12. A keyboard device comprising: a fluid amplifier having only one control signal input; a jet-pipe having an orifice in one end thereof; and key operated means connected to said jet pipe for selectively positioning said orifice opposite said control signal input.

No references cited.