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PNEUMATIC KEYBOARD  
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3,034,628

FIG. 1

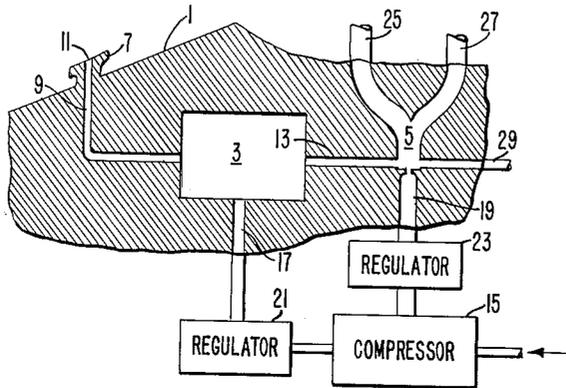


FIG. 2

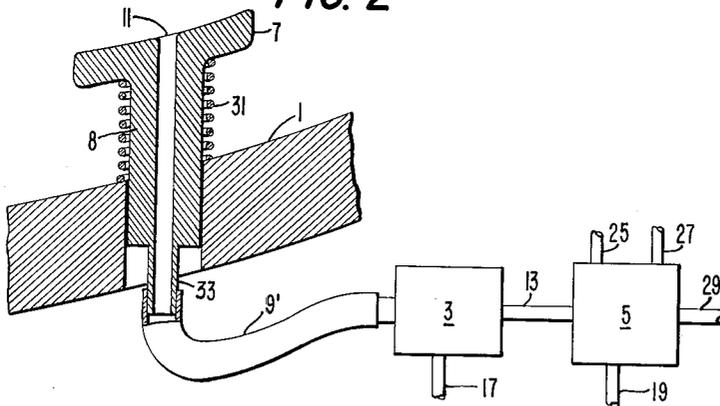
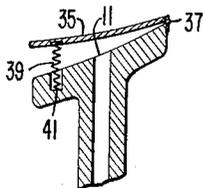


FIG. 3



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**PNEUMATIC KEYBOARD**

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10 Claims. (Cl. 197-15)

The present invention relates to manual input devices for data processing systems. More particularly, the present invention relates to pneumatically operated keyboard devices for manually inserting data into fluid operated data processing systems. The invention provides a keyboard input device which requires no intermediate transducer for converting the mechanical energy of the human operator into fluid signals suitable for use in the data processing system.

The advent of the fluid amplifier has led to the development of data processing and control systems wherein the processing and control functions are carried out by elements which operate entirely on fluid principles. That is, these systems contain no moving parts other than the working fluid which flows through the system. These systems are defined as pure fluid systems to distinguish them from fluid-actuated systems wherein the working fluid operates moving or mechanical parts.

Keyboard input devices of the prior art have been of the fluid-actuated type. In these devices, the fluid signals received from a keyboard actuate pistons or other mechanical elements, to perform the work functions. Because of the mass of mechanical elements, these devices are limited in their speed of operation. Also, because of the mechanical elements, these devices are subject to wear thus decreasing reliability and increasing maintenance costs.

Therefore, an object of the present invention is to provide a pure fluid system for inserting information into a fluid data processing device.

Alternatively, an object of the present invention is to provide a keyboard device for inserting data signals into a fluid data processing device, said keyboard having no moving parts.

A further object of the present invention is to provide a pneumatic keyboard input device for a fluid system, said keyboard input device producing, without the aid of an intermediate transducer, signals of the type used in said fluid system.

Further objects of the present invention and its mode of operation will become apparent upon consideration of the following description and drawings in which:

FIGURE 1 is a view, partly in section, of a keyboard according to the present invention;

FIGURE 2 is a modification of FIGURE 1 wherein the keys are depressable; and,

FIGURE 3 illustrates one manner in which foreign particles may be prevented from entering the fluid system.

FIGURE 1 is a sectional view showing a single key of the type normally found on typewriter, keypunch and adding machine keyboards. For the sake of clarity, a single key and its associated mechanism are shown, but it will be obvious to those skilled in the art that a plurality of key mechanisms may be provided on a single keyboard, the number of keys and their arrangement being determined by style and design considerations.

In a preferred embodiment, the keyboard 1 contains a fluid chamber 3 and a fluid amplifier 5 for each of the keys 7. A tube or fluid passageway 9 extends through the keyboard and keystem and terminates at one end as an opening in the chamber 3. The other end of passageway 9 terminates at an orifice 11 in the surface of the key. A second passageway 13 connects with the chamber 3 and

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is connected to serve as the control signal input for the fluid amplifier.

A fluid source such as compressor 15 supplies fluid to the chamber 3 through passageway 17, and supplies fluid to the power stream input of the fluid amplifier 5 through passageway 19. The fluid pressure in passageways 17 and 19 is suitably regulated by pressure regulators 21 and 23 respectively.

The pneumatic keyboard of FIGURE 1 operates as follows. The working fluid, preferably air, is constantly applied through passageway 17 to chamber 3. The fluid is applied at a substantially constant pressure under the control of pressure regulator 21. When no keying is taking place, the fluid in the chamber flows through passageway 9 and passes out of the system into the surrounding atmosphere through orifice 11 in the key.

When the operator presses a finger against the key, orifice 11 is blocked. This, of course, blocks or materially reduces fluid flow through passageway 9 and causes an increase in the fluid pressure within the passageway. The increase in fluid pressure is reflected back through the chamber and is applied to the fluid amplifier over control signal input passageway 13.

Fluid amplifier 5 is a bistable device which may operate on the "boundary layer" principle as described in the June, 1960 issue of Science and Mechanics. In the normal state, the jet stream issuing from tube 19 is locked against the left wall of the amplifier chamber and flows out the left conduit 25. The conduit 25 may be returned to the low pressure side of the fluid system or, if desired, the conduit 25 may be connected to the control system to give a positive signal indication that the key has not been operated.

An increase in pressure in the control signal input tube 13, resulting from the orifice 11 being closed, causes dissipation of the low pressure region and boundary layer along the left wall of the amplifier. As a result, the jet stream issuing from tube 19 switches to the right output conduit 27 and locks on to the right wall of the amplifier. The signal issuing from conduit 27 may be used to perform some work function such as entering into a storage register a data character corresponding to the actuated key. Alternatively, the signal on conduit 27 may control the printing or punching of a record medium with a symbol corresponding to the actuated key.

The amplifier is provided with a second control signal input 29 for resetting the amplifier to its normal state after the work function has been performed. It will be obvious to those skilled in the art that if a plurality of keys and amplifiers are provided, the reset signal may be applied (by mechanism not shown) to reset all amplifiers simultaneously. Thus, the present keyboard mechanism is admirably suited for parallel entry of information into a storage register. Also the keyboard mechanism itself has the capacity to store information signals, these signals being stored from the time a key is depressed until the reset signal is applied to the amplifier.

In FIGURE 1, the key 7 may be stationary and formed as an integral part of the keyboard.

FIGURE 2 shows an arrangement whereby the key 7 may be depressed in order to give the operator the familiar feel of a mechanical keyboard. The keyboard frame is provided with a plurality of holes, each hole being large enough for the keystem 8 to slide freely without wobbling. The keystem slides up and down within the frame of the keyboard. A compression spring 31 normally holds the key in the upward position. When the operator places a finger on the key, the force exerted on the key depresses the spring. Upon removal of the finger, the spring returns the key to its normal position.

A fluid passageway extends through the key and ter-

minates at orifice 11 in the upper surface of the key. The bottom of the keystem is formed with a pipe-like projection 33 surrounding the lower portion of the passageway. A flexible hollow tube 9' is affixed to the projection, the other end of the flexible tube being connected to a chamber 3. In the arrangement of FIGURE 2, the chamber 3 and fluid amplifier 5 comprise separate bodies and are not formed within the body of the keyboard as in the embodiment of FIGURE 1.

The orifices 11 may tend to become clogged with foreign matter if not protected. As shown in FIGURE 3, foreign matter may be prevented from entering the orifices by providing each key with a cover or flap 35 connected to the key by means of a hinge 37. A compression spring 39 is attached at its lower end to the bottom of a hole 41 bored in the upper surface of the key. In its normal position, the flap rests against the compression spring thus leaving an opening between the flap and the face of the key through which the fluid may pass.

When the operator applies pressure to the flap, the spring is compressed into the hole 41. This permits the flap to lie flat against the face of the key thus sealing the orifice 11 and producing a back-pressure in the manner described above.

As discussed in the aforementioned publication, fluid amplifiers may comprise grooves or channels stamped or formed in a flat plate of plastic, metal or other material. The stamped plate is then placed between solid plates to form a laminated structure having channels therein. This method of construction is admirably suited for fabrication of a keyboard as shown in FIGURE 1 wherein the fluid amplifier 5, chamber 3 and the tubes 9, 17 and 13 comprise fluid channels and chambers within a substantially solid keyboard 1.

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, the bistable fluid amplifier 5 may be replaced with a push-pull fluid amplifier of the type described in the aforementioned publication. In this case, the signal applied to control signal input 29 will be a continuous signal which balances the signal on control signal input 13 when the orifice 11 is open. With this arrangement, no reset signal is required and the amplifier has no storage or memory ability.

It is intended therefore to be limited only by the scope of the appended claims.

I claim:

1. A keyboard mechanism comprising: a fluid amplifier having a control signal input; a fluid chamber connected to said control signal input; a key having an opening in the face thereof; fluid conducting means connected to said fluid chamber and terminating at the opening in said key; and means for applying fluid under pressure to said fluid chamber.

2. A keyboard mechanism as claimed in claim 1 wherein said fluid conducting means comprises a passageway extending through said key and a flexible hollow tube connected to said passageway and said chamber.

3. A keyboard mechanism as claimed in claim 1 wherein said fluid amplifier is a bistable fluid amplifier having a further control signal input to which reset signals may be applied.

4. A keyboard mechanism comprising: key means having exhaust means therein; a pressure regulated source of fluid; fluid amplifier means; and means connected to said source of fluid for exhausting fluid through said exhaust means when said exhaust means is open, and for applying fluid signals to said amplifier means when said exhaust means is blocked.

5. In a keyboard of the type wherein each key has a port for exhausting fluid, the improvement comprising: a fluid amplifier; a source of fluid; and means for conveying said fluid to said port, said means applying fluid signals to said amplifier when said port is blocked.

6. The device as claimed in claim 5, and further comprising a protective flap for blocking said port.

7. In combination: a keyboard having a plurality of ports in the surface thereof; a plurality of fluid amplifiers; a source of fluid; means for exhausting said fluid through said ports; and means connected to said amplifiers and said ports for applying fluid pressure signals to said amplifiers when said ports are blocked.

8. A keyboard device comprising a unitary body having a plurality of chambers, fluid passageways and fluid amplifiers therein, each of said passageways terminating at one end at a port in the surface of said body and terminating at the other end at a port in one of said chambers, said chambers being connected to said fluid amplifiers to apply control signals thereto; and a second plurality of fluid passageways for applying fluid to said chambers.

9. In a pneumatic keyboard of the type wherein each key has a port in the surface thereof, the improvement comprising a protective device for preventing foreign matter from entering said port, said protective device comprising a flap disposed adjacent the surface containing said port, and hinge means attached to said flap and said key, the surface of said flap adjacent to said port being contoured to close said port when said flap is depressed.

10. A mechanism comprising: exhaust means, fluid amplifier means; a source of fluid; and fluid conducting means connecting said source of fluid to said exhaust means and said amplifier means.

References Cited in the file of this patent

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**Notice of Adverse Decision in Interference**

In Interference No. 93,471 involving Patent No. 3,034,628, W. G. Wadey, PNEUMATIC KEYBOARD, final judgment adverse to the patentee was rendered Nov. 29, 1965, as to claims 1, 4, 5, 7 and 10.

[*Official Gazette June 28, 1966.*]