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FLUIDIC SINGULATOR

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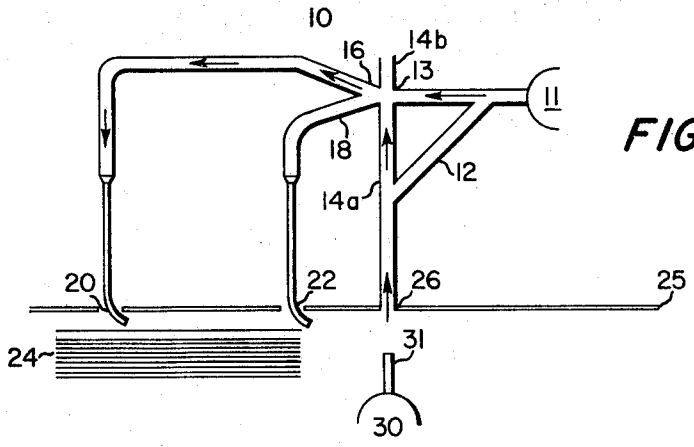


FIG. 1

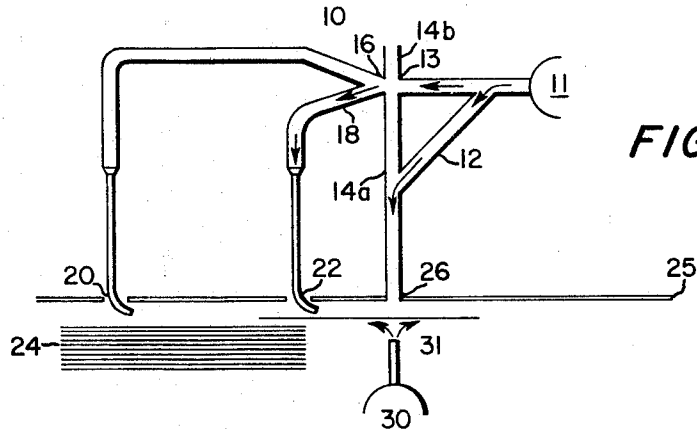


FIG. 2

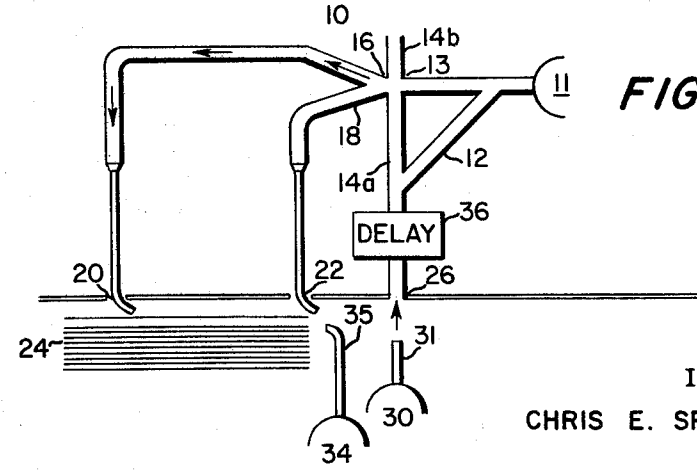


FIG. 3

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FLUIDIC SINGULATOR

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ABSTRACT OF THE DISCLOSURE

A means utilizing fluidic techniques for singulating cards, letters or the like from a stack and directing the singulated item along a conveying surface. One output channel of a self-biased fluid amplifier is used to direct a fluid stream against the top card in a stack of cards and propel it laterally. A sensing means detects the moved card and causes the amplifier to switch to a second output channel which causes the card to move further along the conveying surface. After the moved card proceeds beyond the sensing means a fluid output will again be produced on the first output channel. A delay means may be used to regulate the rate at which the amplifier switches, and, thus the rate at which the cards are singulated from the stack and moved along the conveying surface. To minimize friction between the card benig conveyed and a next card in the stack a jet of air may be directed against the motion of the card being conveyed on a side of this card opposite the side exposed to the outputs from the fluid amplifier.

RIGHTS TO THE GOVERNMENT

The invention described herein may be manufactured, used, and licensed by or for the United States Government for governmental purposes without the payment to me of any royalty thereon.

BACKGROUND OF THE INVENTION

In the prior art there are a vast number of devices for sorting cards and letters and the like and conveying them. Each of these devices, however, have the same disadvantage. That is, each of them uses complicated mechanical parts which are subject to wear and tear over the course of time. Such sorting means generally utilize a mechanical finger for detecting the card or letter to be removed from its stack or otherwise sorted, or alternatively use an electrical brush contacting means in order to close an electric circuit. Further mechanical means are then utilized to remove the card from the stack and propel it along a conveying surface or to perform other sorting operations. All such mechanisms by their very nature require a large number of linkages, cams, gears, or the like, and if electric means are used, a large number of actuating relays and other electric circuitry will be required. Therefore, it is quite obvious that the prior art devices, be they mechanical or electrical, require a substantial amount of maintenance and are relatively expensive.

In the handling of letters or the like, when it is required that a large number be processed in a short period of time, there is a requirement for a device which will remove only the top letter or the like from a stack of such items and cause it to be conveyed. A major difficulty in this area, however, is that the present mechanical means being used tend to damage the articles that they are handling. This, in addition to the other disadvantages mentioned above for mechanical and electrical sorting devices, clearly points out the need for a device which will perform the aforementioned sorting function not having the disadvantages of conventional mechanical and electrical devices.

The present invention seeks to obviate the above disadvantages by instead using fluid to remove a card, letter or the like from a stack of such items and cause it to be propelled along a conveying surface. This approach eliminates the need for moving mechanical parts which in turn simplifies the construction of the device and makes its operation more reliable than has heretofore been possible. Precise control and timing in the invention is accomplished through the use of a pure fluid amplifier which uses a relatively low power sensing fluid to control a high power card propelling fluid without the need for cumbersome mechanical transducers or the like.

It is therefore an object of this invention to provide a singulator means requiring no moving mechanical parts and in which seensing, singulating and sorting are accomplished by fluid means.

SUMMARY OF THE INVENTION

The above object and others are accomplished in a means which uses the output channel of a self-biased fluid amplifier or other biased fluid switching element to propel a card, letter or the like along a conveying surface. The fluid stream emanating from one of the output channels of the fluid amplifier impinges on the top card in a stack at such an angle and with such force that it is caused to move laterally along the conveying surface. After the card has been moved it interrupts flow into one of the control channels of the fluid amplifier causing the output to switch to a second output channel which further moves the card along the conveying surface. When the card has moved away from the control channel of the amplifier the output will be switched to the first output channel again causing another card to be propelled along the conveying surface. A self-biased fluid amplifier is used which when no fluid is flowing in any control channel causes the output to automatically emanate from a predetermined output channel.

BRIEF DESCRIPTION OF THE DRAWINGS

The specific nature of the invention as well as other objects, aspects, uses and advantages thereof will clearly appear from the following description and from the accompanying drawing, in which:

FIGURE 1 is a top schematic view of the present invention in a first mode of operation;

FIGURE 2 is a top schematic view of the present invention in a second mode of operation; and

FIGURE 3 is a top schematic view of an alternative embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIGURE 1 the preferred embodiment of the present invention is shown operating on a stack of cards **24** which have been placed on their edges with their sides adjacent to a conveying surface **25**. The fluid amplifier **10** is of the self-biased variety and includes a fluid power source **11** for delivering a power stream to an interaction chamber **13**. Output channels **16** and **18**, respectively, communicate with interaction chamber **13**. Relatively low power fluid signals may be supplied through either control channel **14***a* or control channel **14***b* to interaction chamber **13** at generally right angles to the path of the power stream emanating from source **11**. Control channels **14***a* and **14***b*, respectively, act to selectively deliver control stream signals to interaction chamber **13** in order to deflect the power stream into one of the output channels **16** or **18**. A bias channel **12** is provided which has one end connected slightly downstream of power source **11** diverting a portion of the power stream into control channel **14***a*. The portion of the power stream which is passing through the bias channel moves into control channel **14***a* in a direction away from interaction chamber **13**. When power is

turned on, the flow through bias channel **12** and the main power stream create a low pressure area within the section of control channel **14***a* between the interaction chamber **13** and the point at which bias channel **12** intercepts control channel **14***a*. This reduced pressure area acts to entrain the power stream in output channel **18** in the absence of control signals. If a control signal is applied to control channel **14***a*, the pressure will tend to divert the bias flow from a direction out of control channel **14***a* and move it through the control channel in the direction of interaction chamber **13**. The results of coupling a pressure signal into control channel **14***a* will be that the power stream will be deflected from output channel **18** into output channel **16**. It can therefore be seen that in the absence of control signals fluid amplifier **10** automatically resets itself so that the power stream is directed into and through output channel **18**.

In using self-bias fluid amplifier **10** to singulate and propel the top item from the stack **24** the output channels **16** and **18** are extended to and terminate in nozzles **20** and **22**, respectively. Nozzles **20** and **22** are placed at such an angle and position with respect to stack **24** that the fluid stream emanating therefrom will cause the top item on stack **24** to move laterally away from the stack.

In the mode of operation shown in FIGURE 1 a second fluid power source **30**, through nozzle **31** directs a relatively low power stream into control channel **14***a* causing the power stream in the amplifier to be deflected into the output channel **16**. The flow from output channel **16** through nozzle **20** causes the top item in stack **24** to be moved laterally along conveying surface **25** in the direction of nozzle **22**.

In FIGURE 2 the top item which has been moved from stack **24** is shown interrupting the flow from nozzle **31** into control channel **14***a*. With no control signal being coupled into fluid amplifier **10** it will reset itself in the manner described above so that the power stream is directed into output channel **18** and out of nozzle **22** causing the item to be further propelled along conveying surface **25** away from nozzle **31**. This now allows flow to be resumed between nozzle **31** and control channel **14***a* deflecting the power stream in fluid amplifier **10** back into output channel **16** so as to singulate and propel the next item which is now the top item on stack **24**.

In FIGURE 3 is shown an alternative embodiment of this invention. In this embodiment a fluidic delay means **36** is interposed in control channel **14***a*. After a singulated item has passed by and flow is resumed between nozzle **31** and control channel **14***a* this control signal is delayed in its passage to interaction chamber **13** by fluidic delay **36**. The time after the passage of the singulated item at which the power stream in fluid **10** will be deflected from output channel **18** to output channel **16** may then readily be controlled by delay **36**. This, of course, regulates the singulating rate of the system.

To minimize friction between the card being conveyed and the next card in the stack **24** a third fluid power source **34** coupled to nozzle **35** directs a jet of air against the motion of the card being conveyed on the side of this card opposite the side exposed to the outputs of nozzles **20** and **22**. This will tend to separate the card being conveyed and the next card in the stack.

It will be apparent that the embodiments shown are only exemplary and that various modifications can be made in construction and arrangement within the scope of the invention as defined in the appended claims.

I claim as my invention:

1. A means for removing one card-like item from a stack and for directing said item along a conveying surface, comprising:

(a) a first propelling means for causing a fluid jet to impinge upon the top item of said stack at such an angle and with such force that only said top item will be caused to move laterally along said conveying surface;

(b) a second propelling means for causing a fluid jet to impinge upon said top item removed from said stack by said first propelling means at such an angle and with such force as to cause said item to move further along said conveying surface;

(c) switching means for causing either said first propelling means or said second propelling means to be operative; and

(d) sensing means for causing said switching means to render said second propelling means operative while rendering said first propelling means inoperative when said item is adjacent to said sensing means and for rendering said first propelling means operative after said item is caused to move along said conveying surface away from said sensing means by said second propelling means.

2. The apparatus of claim **1** in which said switching means is a fluid amplifier having a first fluid power source and at least one control channel adapted to deflect the power stream issuing from said source into one of at least two output channels.

3. The apparatus of claim **2** in which said sensing means comprises a second fluid power source directing a fluid stream into said one control channel, said second fluid power source and said one control channel being positioned so that the fluid flow therebetween will be interrupted after said top item has been moved along said conveying surface by said first propelling means causing said switching means to render said second propelling means operative and said first propelling means inoperative.

4. The apparatus of claim **2** in which said first propelling means is a first output channel of said fluid amplifier and said second propelling means is a second output channel of said fluid amplifier.

5. The apparatus of claim **4** in which said sensing means comprises a second fluid power source directing a fluid stream into said one control channel, said second fluid power source and said one control channel being positioned so that the fluid flow therebetween will be interrupted after said top item has been moved along said conveying surface by said first propelling means causing said switching means to render said second propelling means operative and said first propelling means inoperative.

6. The apparatus of claim **5** in which said fluid amplifier is a self-biased amplifier so constructed that when there is no flow into said one control channel, said power stream will automatically flow into said second output channel.

7. The apparatus of claim **5** in which a fluidic delay means is interposed in said one control channel.

8. The apparatus of claim **5** in which a third fluid source directs a stream against the motion of said item being conveyed on the side of said item opposite the side exposed to said first and second propelling means.

References Cited

UNITED STATES PATENTS

2,956,801	10/1960	Coapley	271—5
3,260,519	7/1966	Coleman	271—5

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U.S. Cl. X.R.

271—5, 74